The Infantry School

MAILING LIST

A Semi-annual Publication Containing the Latest Thought on Infantry

VOLUME XII—JULY 1936

Prepared by the
Academic Department of the Infantry School
under the supervision of the
Assistant Commandant

U.S. DISTRIBUTED BY THE BOOK SHOP
THE INFANTRY SCHOOL, FORT BENNING, GEORGIA

6750—BENNING, GA., 5-5-30—5,000

OCT 27 '42

PREFACE

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OCT 27 '42

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CHAPTER 1

The Personality Factor In War

(AN INFANTRY SCHOOL STUDY)

A leader so intimately acquainted with the character of his opponent as to be able to predict with certainty what he will do under any given circumstances may set aside with impunity every established rule of war.

—Henderson.

All tactical instruction has a definite mechanistic background. Notwithstanding the lessons of history that show us conclusively how victory does not always go to the side with the heaviest battalions, nor to the side which has initially the tactically superior dispositions, school problems are invariably decided on this basis. There are, in reality, factors more important than numerical strength or even superior dispositions. Training, discipline, morale, personality of commanders, national morale, and the like, exert a profound, and generally a decisive, influence on all battles.

All such items, however, are deliberately left out of map problems on the ground that it is impossible to assume a value for intangibles. This leads the student, though he may be little aware of being led, to the conclusion that war is entirely an affair of invariable and easily measurable factors, that an army is only a machine, and that a commander has only to know the right levers to shift in order to secure victory. It is never driven home to him, for instance, that battalions are not solid blocks but unstable organizations liable to disintegrate under certain

conditions, and that commanders are not simple robots, all responding alike to a given stimulus, but men of complex temperaments each of whom has his individual—even unique—reaction. Nevertheless, there is only one thing of which the student can be sure: He will never encounter General *A*, the intellectual automaton of the map problem, on any battlefield.

Furthermore, in the study of military history this neglect of the non-physical elements of war has far too often concentrated all attention upon its physical aspects. Victory, in consequence, is usually ascribed to some maneuver that can be plotted clearly, whereas it is more likely to be due to an intangible factor such as the personality of the commander. The maneuver that one commander pushes through to a brilliant success, tried by another, may lead only to a miserable failure. What if the troops lack confidence in their commander—or the commander lacks resolution to push his attack home? Burnside might have conceived some of Lee's plans but if he had tried them he would in all probability have failed. He lacked at least one of Lee's personal qualities—intelligence—which in essence made Lee's schemes of maneuver possible. Does it profit us to neglect such a factor of war as that? And of these personal qualities intelligence is only one, and, though readily recognized, perhaps not the most important. We may debate how true it is that "In war all things are simple but the simple is difficult," as Clausewitz said. Why not flatly admit that it takes no intellectual giant to comprehend or devise a scheme of battle; but it takes a giant of some sort to execute. And then, going further, try to ascertain what qualities are responsible for the successful execution. In short, place the emphasis on the difficult execution, not the simple plan.

A maneuver, whether simple or difficult, is actually but the extension of the personality of one man—the commander. To consider it only as a simple pattern for the application of physical force in a geometric direction is totally false. Yet this is our viewpoint, gained at great sweat over maps and overlays. The pattern of battle is

all, and the man nothing. Our training, our tactics, and our study of military history bring us, unless we are indeed of tough mind and open, to that distorted stage at which we grind out a mechanical solution, apply it to mechanical units, and get a mechanical result. That may seem desirable in this day of mechanical warfare; but no, it will never be desirable until we get mechanical men; and even then it will take brains to push the buttons.

Yet it is also true that in military history to evaluate factors outside the physical realm is exceedingly difficult; and accordingly, it is not unnatural for us to thus concentrate on the easily tabulated and plainly charted details of campaign and battle. Often, indeed, the obstacles to estimating even the effect of a commander's personality alone, may appear insurmountable.

In the first place the estimate of an historic personality is the boiled-down decision of posterity, which has had a chance to see both sides of the man and his problem and has very likely arrived at a full estimate, however accurate or inaccurate. Certainly it is not always accurate. Prejudice, national pride, and other emotional factors too often conspire to give us a picture of a personality far different from the truth. Hannibal, whose accomplishments are known to us only through his enemies, was very likely a man quite different from the Hannibal of our histories. The fact that his character dominates the Second Punic War, and that even his bitterest enemies could not diminish his stature, is testimony, of course, to the transcendent genius of the man. We can say that much; but we cannot say we know Hannibal or his personal technique of action. Washington as painted in most history books is far different from the person he actually was, or appeared to be, to his contemporaries. We have trimmed off the humanity of the man to obtain by our pruning a stiff legendary hero devoid of the slightest informality or fault. Robert E. Lee has been going through the same process. Figures thus trimmed to fit our story books are valueless in estimating the personality factor in war. They are untrue.

The man who as a child builds up a folk-lore concept of

an historical character will, as a man, find it difficult (for some men it is impossible) to consider this character in any other guise. The impressions of youth cannot be discarded like an old coat. They are more in the nature of a scar, which only an operation will remove, and even then leave its cicatrice.

To sum up our first difficulty in determining the values to give the non-physical factors of war: History may give us the correct picture of a personality, or it may give us a distorted picture; and we ourselves are all too liable to gaze at either picture with eyes dimmed by emotion born of childhood schooling.

But there are further difficulties, not the least of which is that we do not even know precisely what personal qualities in a commander are essential; and we have no clear terminology to describe those qualities if we knew them, no scales to weigh them, no method of measuring them. Not an auspicious start to the study of the influence of personalities on battle. But the end is not yet.

Of every battle studied we know the answer—who won. And being only human, this fact warps our judgment. Like the child who looks in the back of his arithmetic to find the answer, and then tries to juggle the figures of his problem until he gets the same result, we unconsciously juggle our available facts and sequences of events to show how a battle took the form it did. The pressure to do so is great. We are under the necessity of showing causation, or else we must admit that war is a game of chance and battle but a toss of the dice. This admission we cannot make, for it would destroy the whole fabric of military education and make impossible a military science or art. But since we omit or slur the intangible psychological factors, such as the influence of a commander's personality, we throw away factors in our equation which, according to one authority, are three times as important as the physical facts. The result is a battle picture constructed of physical data alone. And in order to show how inexorably these data produced victory we are reduced to some very ridiculous rationalizing.

Thus we arrive again at the main point. To show how effects flow from certain causes in war we must include what heretofore have been regarded as intangibles. Let anyone who doubts this study the battle of Cannae. On the basis of that battle, only a master of dialectics could prepare a case for dominance of the physical factor in war, only a sophist would present such a case, and only a simpleton would be convinced by the arguments.

A bland disregard of the non-physical factors of war leads to some delightful pieces of rationalization. Napoleon's marshals in Spain had poor success against Wellington. Hence, it is argued, they were poor commanders away from Napoleon. Yet in the same breath Wellington is given great credit for defeating them. This, itself, is droll, but it is only incidental. The point is that a thorough analysis of the campaigns in the Peninsula, attributing a fair weight to the mental attitude of the Spanish people, might well reach the conclusion that it was not Wellington who defeated the French so much as the fanatic hostile peasantry egged on by the clergy. Eliminate this factor; or, better, reverse conditions. Imagine Wellington operating against Massena in the revolutionary Ireland of 1916-1920. Then the shoe would be on the other foot, and old, one-eyed Massena might have justified the remark that Wellington was only a "Sepoy general." Yet here we tread on dangerous ground for we are likely to arouse the passions of admirers of Wellington. So hard is it to look at great personalities objectively.

Indeed, perhaps the greatest single item that prevents true appreciation of the personality factor in war is our acceptance of the historical verdict. With the historical estimate of a particular general before us, we are unable to understand why his opponent did not take advantage of certain weaknesses in his character; or on the other hand, we wonder why another general should be so foolhardy as to try something risky in the face of a master of maneuver. We forget that generals fighting a war do not have the verdict of history to help them. They

must find out for themselves, and in this process often get burned—or just as often gain a victory.

Thus, in studying the personality of a commander and how he plays his opponent, we are often safer in taking the contemporary opinion of his opponent than the historical opinion. Not because the contemporary opinion is more accurate, but because it is far more likely to be the opinion that was held by the general we are studying and the opinion that motivated his actions. Robert E. Lee thought highly of McClellan, as did hosts of people in the North. History does not reach the same conclusion. Lee may have been correct and the documentary historians wrong; but in any event it was not the historians' estimate of McClellan that Lee held.

Again summing up, with fair assurance we can at least say this: To obtain a proper appreciation of a commander's character and ability we must first place ourselves in that commander's shoes; we must be certain that we have no prejudices, national or otherwise, concerning him—no hero worship; we must be wary of accepting historical judgments as to the worth, or the worthlessness, of his opponent; we must be sure that our evidence concerning him and the battle is substantially correct; we must feel the impact of contemporary knowledge and events as a participant—a man of the day—not a cold-blooded dissector of documents—a scholar; and above all we must not know how the battle will turn out, for to do so will certainly warp our judgment. As humans we cannot help believing that the victor was right, and then steadily rationalizing to prove his actions and our conception of them correct.

True, it is simple to build up a map problem and then state what the proper action should be. But the cynical student often refuses to be convinced that the solution is sound or that any commander would act that way. It takes the crash of actual battle, the impact of armed masses, and the decision of the God of Battles to convince him that a maneuver or a decision was correct.

But how can we do all that? Perhaps we cannot; but in the next chapter we shall have a try at it. And you, if you care to, can match your wits against a personality and see a real one in action.

CHAPTER 2

The Affair at Chernastovna

(An Infantry School Study)

Wu the Master said:
"The secret of war is, first, to know who is the enemy's general, and to judge his ability."

—The Chinese Book of War,
5th Century B. C.

It would appear that the difficulty of estimating the effect of personality on battles and balancing it against the physical factors of war is insuperable. But we can at least try it; and for this try we shall consider only the one elusive factor—the personality of the commander. We should remember, too, that we are not trying to illustrate tactics but to ascertain, if possible, the influence of the personality factor in war. To the reader will be left the decision whether this influence is paramount, or whether its effects are negligible. Certain data will be presented but no dogmatic conclusions drawn. The reader and the writer, together, will try to explore the realm of personality, and each will reach his own conclusions.

Since General *A* of the stock map problem has no personality, the basis will be a typical synthetic map problem like those so often given at our schools. The situation will be made brief. The problem should be solved like any other map problem. For once we will get away from terrain that everyone knows and on which innumerable map problems have been solved—so many, in fact, that the student could almost call the roll of the farming in-

habitants from memory, or give the height of every hillock. Then finally we shall give it a name by calling it "The Affair at Chernastovna".

THE MANEUVER

GENERAL SITUATION

(See Figure 1.)

Blue (north) and Red (south) have been at war for some time. Blue after decisively defeating the attempt of a superior Red force to cross the Sanar river near Friestadt has settled into winter quarters. His position on the heights in rear of Friestadt is a formidable one. He has lost for a time a portion of his force, about 20,000 men, which is on an independent operation by order of higher authority; but he has 62,000 men along the river line which he stoutly holds. He is supplied by two main arteries: one runs due north from Friestadt, and the other through Orzanburg to the north. This second route is connected to Friestadt by the roads that run through the bottleneck at Chernastovna. Blue has strongly fortified the river from Porloff to Barzin Ford.

Red, after his repulse in trying to cross the Sanar, has taken up a strong position on the heights of Farzcyki facing Blue. He now has about 130,000 men and covers the river front with vigilance. His line of supply runs to Arswick. It is well covered by the river and the mass of his troops.

The Sanar river is unfordable up to Barzin Ford. East of that the Uzarvitch and Kurthburg crossings permit the passage of troops, but with difficulty depending on the state of the river. Both sides cover these crossings with great care. Red cavalry is superior to the Blue in numbers. Red, however, during his period of inactivity, has raided across the Sanar river with cavalry at Kurthburg crossing.

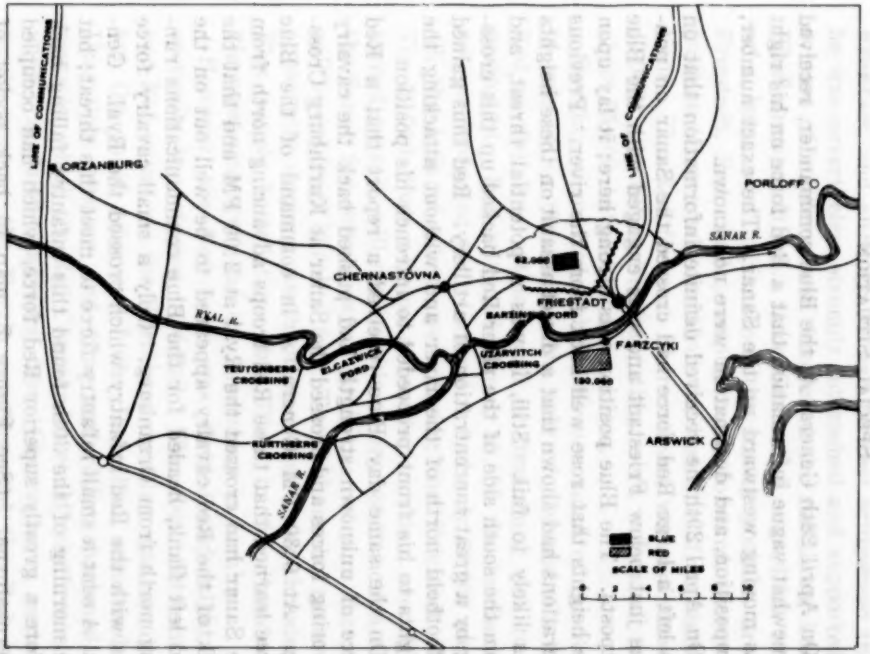


FIGURE 1.—General situation along the Sanar River.

Red plans a general advance as soon as weather conditions permit.

SPECIAL SITUATION

On April 28th General *A*, the Blue commander, received somewhat vague information that a Red force on his right was moving westward up the Sanar. The exact number, composition, and destination were not known.

On April 29th he received definite information that on his left a large Red force had crossed the Sanar on pontons just below Friestadt and was engaged with the Blue outposts. The Blue position was strong here; it lay upon the heights that rose well back from the river. Previous operations had shown that a direct assault on these heights was likely to fail. Still, it was a potential threat, and from the south side of the river Red backed up this crossing by a great concentration of artillery. Red thus gained a foothold north of the river and without attacking the heights to his front proceeded to intrench his position.

On the same day Blue received a report that a Red force of unknown strength had pushed back the cavalry covering forces and crossed the Sanar at Kurthburg Crossing. At 6:30 PM General *A* in command of the Blue force learned that these Red troops advancing north from the Sanar had crossed the Ryal at 2:00 PM and that the bulk of the Red cavalry appeared to be well out on the Red left flank, headed for the Blue communications running north from Orzanburg. Only a small cavalry force was with the Red infantry which crossed the Ryal. General *A* sent a small infantry force to meet this threat; but the morning of the 30th found this infantry falling back before a greatly superior Red force, which had occupied Chernastovna. (See Figure 2, map in back pocket of book.)

By nightfall of the 30th the situation facing General *A* could be summed up about as follows: (See Figure 2.) By a rapid secret march the enemy had thrown a large force well out to the Blue west flank, crossed two streams,

turned the river line, and seized the road center at Chernastovna and cut one Blue supply route. Meanwhile he had pushed a strong force across the Sanar below Friestadt, and although he had no real bridgehead there, he was nevertheless strongly intrenched and supported by a mass of artillery, and threatened the remaining line of Blue communications. Once General *A* moved his army, or a large part of it, from the strong position around Friestadt, Red could promptly move forward, storm the position if necessary, and cut the last line of communications. The Red force at Chernastovna was estimated at 42,000; and below Friestadt they were estimated to be about 35,000, but not all were across.

Roughly, then, Red had 70,000 men north of the Sanar in rear of, or threatening the rear of, General *A*'s lines. Red cavalry was within reach of Orzanburg well to the northwest. Red still had almost 50,000 men somewhere not yet accounted for. General *A* had only 62,000 men in all, the bulk of whom were facing the Friestadt Reds. The 20,000 Blues now on a detached mission, even if returned on call, will not be able to engage in action along the Sanar for several days. And it is not sure that they will be returned if called for. The Red cavalry mass was apparently working north on the west flank threatening Blue supply installations, but Blue, in the Friestadt—Chernastovna area, had the supremacy in cavalry.

However, the Red force was divided and might theoretically be defeated in detail. The route between the two Red wings via the Kurthburg crossing was circuitous, but the rapid advance of the Reds had uncovered the Uzarvitch crossing and thus materially shortened the route by which the Red Commander could reinforce either wing. A further advance from Chernastovna eastward would uncover the Barzin crossing and the Red army would then be compactly arranged. With the Uzarvitch crossing alone in Red hands, the Red commander could reinforce either wing until it was larger than the whole Blue force, and still have just as big a force operating as his other wing. The Blues could not strike at Red com-

munications because these communications were covered by the Sanar for the crossing of which Blue had no ponton train.

For General *A* to concentrate and attack either hostile wing would allow the other to move still farther to his rear. The Blues might then find themselves between the upper and nether millstone, and all too soon thereafter, ground to pieces. To remain on the defensive would certainly permit the whole Red army of 130,000 men to invest General *A* in his Friestadt lines. To retire would give up valuable territory and permit both wings of the enemy to unite; moreover, the Blue retreat would be endangered by the Red cavalry on the right flank. However, such a retirement would afford time for the absent portion of his army to join, and in addition enable General *A* to obtain more maneuver room and perhaps gain a position from which he would have a better chance of victory.

True, at the moment Blue had interior lines, but the distances were short, maneuver room was limited, and Red, in perfect safety south of the Sanar, could actually shift troops from one wing to the other and have them ready for battle before General *A* could push an attack home to a complete victory against either wing. The Sanar afforded perfect protection for such Red lateral movements. However, if Red planned to move both wings simultaneously forward to grasp General *A* in his pincers, he would encounter the difficulties that always obtain in these concentric movements. But for Blue to accept battle against a vastly superior force while a portion of his own force is absent would be a violation of one of the basic principles of war.

It might be well to take thought here. It will not serve to curse General *A* for getting into this situation, nor to call on the great god Mars to witness the sheer impossibility of such a situation's arising under competent leadership; nor will it avail to mentally castigate the individual

whose warped brain devised such a situation in order to point out a moral. Let us first see what you as General *A* would do in this situation. If you believe that you would never get into such a situation, then simply imagine an inept predecessor turned it over to you, and that you must do something. And please withhold all criticism until the end of the chapter. That is important.

You have now the bare physical facts of a campaign. Study the map of Figure 2; and after reviewing all data decide what you would do. To save you time, several lines of action that might be followed are given below. Check the one you would follow, but check lightly for you may want to try this on someone else. If you do not agree with any scheme given, jot down your own solution in the space provided.

TEST I

Following are some possible lines of action:

1. Contain the left wing and attack the right wing ....——
2. Contain the right wing and attack the left wing ....——
3. Retire to obtain room for maneuver and then attack——
4. Retire to get room for maneuver, call for the detached unit of your army, and then attack .....——
5. Retire, get all your detached forces together, let the enemy prolong his communications, and go on the defensive .....——
6. Fight a delaying action until the arrival of your detached force .....——
7. Your own decision if it differs essentially from any of the above .....——

TEST II

One more question before we resume the story of General *A*. Considering all physical factors which force has the better tactical situation? Check below.

Red .....——

Blue .....——

So far we have considered this as if it were a standard map problem, entirely mechanical in conception—the bare skeleton of war.

But wait: this is a real situation, not a synthetic one, and a flesh and blood general is here called upon for an immediate decision. That, surely, is a horse of another color. These are real armies, not map ones; the commanders are humans, not intellectual robots.

Let us put some flesh on our skeleton to see whether it makes any change in our situation and our decision. This must be, as far as possible, only the salient information that might reasonably be known to the Blue commander, and that might affect his decisions. We should realize, of course, that we cannot know all the details the Blue commander may have known. In addition we have to be careful not to attribute to him a knowledge of his opponent's personality which the historian later, after much study, concluded to be correct. This general is on his own. And you can go along step by step with him and give your decision to match with his. Only when the haze of the battle has blown away shall we know whether you are correct or he is, or whether both of you are wrong. By then, it may be, you will have gained some insight into the influence of the personality factor in war.

Our General *A* commanding the Blue army is actually General von Liman. So far in the war he has succeeded in out-maneuvering his opponents consistently and has won several notable victories. The Reds respect his ability and have moved cautiously in his presence. As yet they have not gained a major victory over him despite their

numerical superiority. Not so long ago he repulsed with bloody losses a Red attempt to cross the Sanar.

Blue has the advantage of morale over Red because of many victories; but Red has not been driven back on his own soil. Under constant pounding Red troops have stood up remarkably well, and doggedly come back for more. Within the Red ranks are numbers of men (some say as high as 30 percent, but certainly over 18 percent) not of the Red race. Of these non-Red groups, some have not done so well, but others have displayed a courage no whit inferior to that of the national troops. Blue troops, on the other hand, have great courage and drive, and contain only a small foreign element. Red has more cavalry, it is true; but the Blue cavalry, man for man, is better and indeed far better led. The Blue commander must weigh these intangible elements in reaching his decision.

But it is plainly apparent, too, that the Red army, despite its foreign element and its lack of victories, is a formidable fighting machine. Its fighting quality has been determined on many fields. Heretofore its generals have not been equal to their troops. Give it a real general and it may get real results. The jealousy among the Red generals is common gossip. From knowledge obtained prior to the war, and through the lax intelligence precautions since the war, von Liman has had a splendid opportunity to learn the temperament, force, initiative, and character of his chief opponents.

Burgalov the commander of the ill-fated Red attempt to force the crossing of the Sanar has been relieved and replaced by General Hoche. What sort of man is he? He has shown ability of a high order as a corps commander. He has gained the title of a fighting general, and shows up well as a leader of men. He is intelligent, impetuous, bold, and of great energy. He has been highly critical of his previous commanders, but not, it must be admitted, without justice. Even at the Warsanjik military school Hoche had the reputation for criticizing the highest authorities on war. Then he believed in fate, destiny, and

himself, and he probably does still. He drinks, it has been said, to excess; and his soldiers have made a song about his drinking. All in all Hoche might impress us as a quick, resolute, decided man, constant in his friendships and well liked by his troops. He has led a corps and led it well. But can he lead an army? That is the question which presses von Liman for answer.

During the last few months von Liman noticed his opponent skillfully rebuilding the Red army after its repulse at Friestadt. Discipline has tightened, material has poured into the Red lines, and slowly the Red Army takes shape under this new regime. Morale goes up. Red troops, von Liman knows, appear cheerful—even the cavalry, heretofore deficient, has taken to fighting.

All in all, little doubt exists that Red will again attempt to push north. But just where Hoche's main effort will come von Liman doesn't know, even though Blue spies and sympathizers readily move throughout the Red camp and billets. Apparently this fighting general knows how to keep his counsel.

Von Liman with all the facts before him had decided tentatively that Hoche would attempt to cross below Friestadt. The mass of ponton equipment bears this out; and perhaps von Liman, weighing Hoche's character, estimated that a bull-like push, straight across the Sanar, was more in keeping with his personality than subtle maneuvering. One might expect daring and tenacious fighting from him rather than skillful thrust and parry.

Yet, as we have seen, the fighting general, by a lightning swift movement on April 30th, turned the river line, cut one artery of Blue communications, and disposed a strong force ready to seize the remaining line, once von Liman evacuates or weakens the Friestadt position. Unquestionably the maneuver was brilliant. For the first time von Liman, the old gray fox, has been outmaneuvered. So rapid was the Red turning movement that the Blue cavalry corps on the west flank was actually cut off for a time by the Red infantry. Thus von Liman has at least

one answer to the question of whether Hoche could lead an army. He can. Von Liman must also realize that in this regard he had not estimated Hoche's personality correctly. But it is one thing to maneuver an army to battle, and another to fight it in the battle. Has Hoche the moral courage and resolution to withstand the shock and turmoil of combat, the blind groping through the fog of war, realizing all the time that the fate of the battle depends on him and his decisions? This question must be answered, but it will take a battle to decide it definitely. And if Hoche can lead on the battlefield as well as he can maneuver, that battle may well be fatal to von Liman.

On this aspect of Hoche's character we may be sure that von Liman had a world of petty data, far more than we could give here even if we knew it. From this tenuous data he must select the significant items and from them come to a decision. Already one of his decisions regarding Hoche has gone wide of the mark. He cannot now afford to make very many more incorrect ones.

With this bare, sketchy outline of the personality of Hoche—knowledge much less than von Liman had, we may be sure—would you change your original decision, which was based on the material factors alone? Check below what your decision would be now.

TEST III

1. Contain the left wing and attack the right wing ....——
2. Contain the right wing and attack the left wing ....——
3. Retire to obtain room for maneuver and then attack .....——
4. Retire to get room for maneuver, call for the detached unit of your army, and then attack .....——
5. Retire, get all your detached forces together, let the enemy prolong his communications, and go on the defensive .....——

6. Fight a delaying action until the arrival of your detached force .....——

7. Your own decision if it differs essentially from any above .....——

Burgalov, the former Red commander who had displayed no great ability and whose bungling attempt to force the river line was disastrous, as has been stated, was relieved. But if he were in command in this situation would it make any difference in your decision? Place a cross opposite the decision you would make if facing Burgalov.

In the above we have given a brief outline of Hoche as it would be reasonable to assume von Liman knew of him, since it was the prevailing opinion of the time. Perhaps this added personal data has not caused you to change your decision. But suppose we now take characters well known to all—those we have studied—and substitute them for Hoche. Remember that our opinion of the characters below is the historian's opinion—often different from the general contemporary opinion. It is doubtful whether any commander could obtain such an exact analysis. Check your action under each name assuming *that the general named is commanding the Red Army.*

TEST IV

	Grant	*Halleck*	*Burnside*
1. Contain the left wing and attack the right wing	——	——	——
2. Contain the right wing and attack the left wing	——	——	——
3. Retire to obtain room for maneuver and then attack	——	——	——

4. Retire to get room for maneuver, call for the detached unit of your army and then attack ..... —— —— ——

5. Retire, get all your detached forces together, let the enemy prolong his communications, and go on the defensive —— —— ——

6. Fight a delaying action until the arrival of your detached force ..... —— —— ——

7. Your decision if differing essentially from any above ..... —— —— ——

Although the most difficult part of a commander's decision is the estimate of his opponent's personality, he is faced with another almost as difficult—that is the estimate of the personalities of his own subordinates. This may seem easy but it should be remembered that often a man has reached success by his ability to select his subordinates. Grant's choice of Sherman to command in the west was as important to the Union as his hammering at Lee in Virginia. We should expect a commander to have a clear conception of his subordinates, one that will approximate the historical estimate. But this will not be always so. Napoleon did not rate Marshal Davoust among his greatest, yet history after a century of study is slowly reaching the conclusion that Davoust is at least among the first three of the marshals, and one of the greatest soldiers that France ever produced. Nevertheless, the good commander's opinion is likely to be closer to the historical than to the contemporary, and may even be more accurate. Accordingly, we shall not go far wrong if we take the historical estimate.

Let us see whether the personality of von Liman's subordinates will change our battle equation. He has two

chief lieutenants. One of these, von Leffer, is away with the force detached from the Blue army. A small detachment of von Leffer's corps remains under von Liman's direct command.

Von Leffer was a man of brilliant attainments, and a stout fighting general who had demonstrated his worth on many hard fought fields. He was trusted by von Liman, brave to a fault, vigorous in attack, and undaunted by adverse fortune. He was a stubborn fighter, distinguished in the hottest fights and respected by his troops. Von Liman respected his judgment and skill. Von Leffer advised that von Liman fall back to a strong position where he could join him, rather than fight to a decision on the Sanar.

The other corps was commanded by von Johan who had under him the bulk of the troops remaining with the army. He was squarely in front of the Red crossing below Friestadt. Von Johan was, at this date, considered one of the most brilliant soldiers of either side. He was respected, even idolized by his men. Yet he was a somber, austere man, shy and silent. He was bold in planning and energetic in executing. There was no denying his resolution, his stern courage, and the almost fanatical way he waged his battles. His energy was untiring; his plans he kept from his staff and his generals until it was necessary to reveal them. He was a great student of war. His dominant trait was deadly earnestness. Yet some subordinates had questioned his ability; others had even said he was crazy; and sometimes he had not been fully supported by his subordinates. He had secured great success in minor independent actions; and as a subordinate, was highly regarded by von Liman for whom he had done really brilliant work.

So we have von Leffer absent and von Johan directly before the crossing at Friestadt.

Does this fragmentary outline of the two subordinates

make any change in your decision based on the physical factors of battles in Test I? Check one below.

TEST V

Yes .....____

No .....____

But it is extremely difficult, if not impossible, to sketch the personality of a man sufficiently in a few lines to make him stand out boldly and truly. Certainly we cannot expect to picture him as he appeared to von Liman. All we can expect is to put some sort of individual—if only a misty one—before the reader and let him decide whether this personality would affect his plans. But since we have decided that the good commander's opinion of a subordinate is very likely to approach the historical estimate, suppose we substitute, for the moment, certain historical personalities who are familiar to the reader.

Check in the appropriate column below what your action would be in von Liman's position if you had one of the men mentioned in place of von Johan. Also put a cross in the column opposite the name of the man you would desire to carry out your decision, whether you have changed it or not.

TEST VI

	Marshal Ney	*Sherman*	*Stonewall Jackson*
1. Contain the left wing and attack the right wing	____	____	____
2. Contain the right wing and attack the left wing	____	____	____
3. Retire to obtain room for maneuver and then attack	____	____	____

4. Retire to get room for maneuver, call for the detached unit of your army and then attack ..... ___ ___ ___

5. Retire, get all your detached forces together, let the enemy prolong his communications, and go on the defensive ___ ___ ___

6. Fight a delaying action until the arrival of your detached force ..... ___ ___ ___

7. Your own decision if differing essentially from any above .... ___ ___ ___

We have come to the place now where we can do a little analysis. Check back over the various decisions you have made so far. In Test I we had only the physical factors of battle to go on; in the other tests we let these physical factors remain constant but varied the personal factors. Consequently, if at any time you have changed your initial decision, we can say with fair assurance that this change was made because the personality factor of war appeared greater to you than the sum total of the physical factors. It converted a mechanistic set up into a live and human one where anything might happen, and, as you will see later, did happen. If you changed your initial decision, even in the slightest, when you got the bare outline of Hoche in Test III, it indicates that consciously or unconsciously you are sensitive to, and put a high value on, the personality factor. If you only changed it when Grant, Halleck, or Burnside were substituted for Hoche in Test IV it indicates that you realize the importance of the personality factor, will utilize it, but must be sure you know the personalities. For in this last you have accepted the judgment of history relative to the individuals, something a general in the field is unable to do. He must gather his

data and make his own inferences and judgments as he goes along. He cannot wait for the verdict of history. The moral to all this is that our data on an opponent's personality should be, so far as possible, almost as complete as that which history after years of study accumulates, and our decisions based on this data should reach almost historical accuracy. That is the ideal that can probably never be attained.

There was good reason then for Napoleon to fill a carriage with detailed data regarding the character and personality of his opponents. And the same good reason actuated the German General Staff in accumulating data on the personality of generals against whom they might some day operate.

The reader who has consistently held to his initial decision has not been impressed by the personal factor even when he has history's cold analysis of a character. He has a tendency to think of war as a purely mechanistic affair. Such a person may spiritedly retort—apparently with some justice—that with the situation as sketched there is only one sound solution, and whether General von Liman is faced by a Hannibal, a Caesar, or a mediocrity, he cannot change the iron ring of circumstance; he is forced to one line of action. It is as simple as two and two make four, and not five. But nothing in war is simple and sometimes two and two make even six.

But if our situation along the Sanar is such that from the physical details alone the proper decision can be reached, then modern war is purely a conception of matter, not of mind, and personalities are but incidental. But let us defer this judgment until we finish with von Liman and Hoche. This is really a mystery tale where we are not seeking to find a murderer but a victor.

In considering Test VI where Ney, Sherman, and Jackson, each in turn, are temporarily substituted for von Johan, did you find that if you had any one of these as a subordinate it would cause you to change your decision? Did you leave your plan unchanged, but find one of these

individuals more suited to it than the ghostly figure of von Johan? Whichever you did, you have allowed the personality factor to affect materially your decision, or your action.

However—and this is vitally important—you, yourself, did not analyze and decide the worth of these men. History did it for you. If you were on the ground you would be faced with making your own estimate. No one could do it for you. And that would be a difficult thing; for many contemporaries of these men had a far different opinion from the historical one of today. Some thought Sherman, for instance, was a lunatic, and the papers openly stated so; Jackson was regarded by many as queer —to say the least; and Ney was flatly called stupid.

As a contemporary you would be bombarded with such opinions, and as a contemporary you must be able to evaluate them, to weigh the impalpable qualities of the man and come to an accurate estimate of his character and how he best can be used. This coupled with the moral courage and resolution to stick to your own estimate, unswayed by the wind of local opinion, is necessary before you, as a commander, can get full value from the personality of your subordinates. It is not so easy to decide when you are dealing with the actual man as with the historical conception of the man.

Before we go on with the problem it should be pointed out that we have so far given no estimate of von Liman. This will be left for the reader to form as the operation unfolds. But to diverge for a time and give another chance to those who still cannot see where personalities might influence this action, let us place other characters in von Liman's shoes. The reader can step out of them for the time being in order to estimate the reactions of these others. Assume, then, that the generals listed below commanded the Blue force. If the fact that one of them commanded Blue would cause a change in your initial decision, indicate by checking in the column headed "Yes". Indicate in column headed "Plan" which plan you believe he would

put in effect by giving it the number in Test I. Then check each commander in turn. If war is a mechanical affair each of these experts should reach approximately the same decision—or they are not experts. Take your choice.

TEST VII

	Yes	*No*	*Plan*
Von Moltke (the elder)	___	___	___
Sherman	___	___	___
Lee	___	___	___
Marshal Massena	___	___	___
Wellington	___	___	___
Hindenburg	___	___	___

If at any time from your initial decision to this last one you have modified your decision or changed it, you have virtually acknowledged that the influence of personalities—only one of the intangibles of war—is great enough to overcome the entire physical set-up of battle. To those who still have in no way changed their initial decision, let them stick to it. Perhaps, they may be right and the only way to tell is to take up the story of von Liman. Stepping quickly forward we stand by his side as he makes his decision.

THE BATTLE

THE DECISION OF GENERAL VON LIMAN

Von Liman decided to leave a small containing force of about 10,000 men in the formidable works at Friestadt

and move at once on Chernastovna with the mass of his army—some 51,000 men—to attack the Red left wing.

What is your opinion of this decision? Check below.

TEST VIII

Excellent—— Good—— Fair—— Poor—— Very Poor——

At 8:00 AM 1 May the Blues had about 45,000 men busily entrenching an excellent defensive position against a Red advance from Chernastovna. But on the arrival of von Johan, the entrenching was discontinued and the advance resumed. The terrain around Chernastovna was heavily wooded and difficult to negotiate off the roads. Weak Red cavalry was soon encountered and promptly driven in on the infantry, which in turn fell back. There was something mysterious in such an easy advance, for the enemy was in great strength. He had pushed the heads of his advance beyond the woods and then recoiled within the forest. Why? Heavy columns could be observed on the roads to the rear. A strong column had been pushed out on the Rudivitch road north of the river toward Barzin Ford, and then was just as mysteriously withdrawn. Late in the afternoon Red resistance became stiffer. It was soon apparent that the Red left wing was standing fast on the defensive in the vicinity of Chernastovna and could not be budged except by a general attack. The heavy growth made reconnaissance difficult although by nightfall it was ascertained that the Reds occupied a position of great natural strength extending from the Sanar to Chernastovna, and thence along the Orloff road. (See Figure 3.)

At nightfall von Liman had a total of about 48,000 men before Chernastovna. He was at a loss to determine the exact number of Reds facing him; nor did he know exactly where the Hoche's reserves were located, nor where they

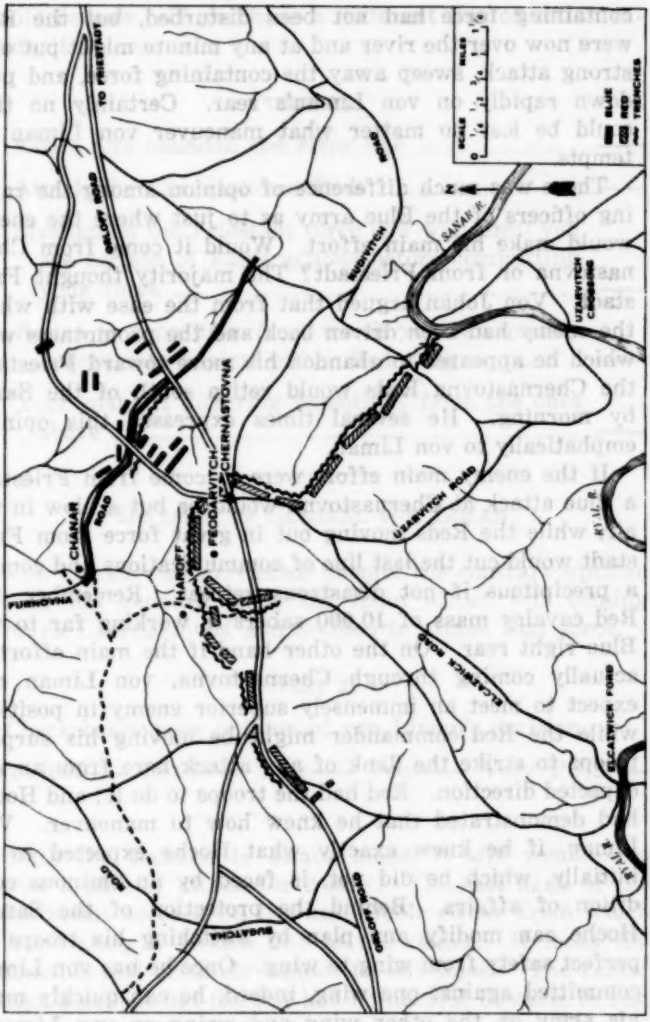


FIGURE 3.—Red position on the afternoon of 1 May.

would be swung into action. At Friestadt the small Blue containing force had not been disturbed, but the Reds were now over the river and at any minute might put on a strong attack, sweep away the containing force, and push down rapidly on von Liman's rear. Certainly no time could be lost no matter what maneuver von Liman attempts.

There was much difference of opinion among the ranking officers of the Blue army as to just where the enemy would make his main effort. Would it come from Chernastovna or from Friestadt? The majority thought Friestadt. Von Johan argued that from the ease with which the enemy had been driven back and the promptness with which he appeared to abandon his move toward Friestadt, the Chernastovna Reds would retire south of the Sanar by morning. He several times expressed this opinion emphatically to von Liman.

If the enemy main effort were to come from Friestadt a Blue attack at Chernastovna would be but a blow in the air, while the Reds moving out in great force from Friestadt would cut the last line of communications and compel a precipitous if not disastrous retreat. Remember, the Red cavalry mass of 10,000 sabers is working far to the Blue right rear. On the other hand if the main effort is actually coming through Chernastovna, von Liman can expect to meet an immensely superior enemy in position, while the Red commander might be moving his surplus troops to strike the flank of any attack here from an unexpected direction. Red had the troops to do it; and Hoche had demonstrated that he knew how to maneuver. Von Liman, if he knew exactly what Hoche expected to do initially, which he did not, is faced by an ominous condition of affairs. Behind the protection of the Sanar, Hoche can modify any plan by switching his troops in perfect safety from wing to wing. Once he has von Liman committed against one wing, indeed, he can quickly mass his army on the other wing and swing on von Liman's rear. Or he may let von Liman attack and concentrate everything in front of this attack.

Check below what you think the action of von Liman should be now. If you have a different line of action indicate it below.

TEST IX

1. Retire and abandon the river line ——
2. Attack the Chernastovna Reds ——
3. Strengthen the Friestadt force and wait until you are certain of Red's actions before committing your force ——
4. Retire to a position from which you can quickly concentrate against either Red wing ——
5. Your plans if differing essentially from the ones above ——

DECISION OF GENERAL VON LIMAN

Von Liman was convinced, despite the contrary opinion among his generals, that the main effort was coming through Chernastovna and decided to attack that force.

TEST X

Check below your opinion of von Liman's decision.

Excellent—— Good—— Fair—— Poor—— Very Poor——

With the decision to attack made, it still remains to devise a plan of attack for 2 May. The east flank of the Reds seems secured on the unfordable Sanar from which it runs along a stream line to the center. It looks impregnable and certainly cannot be enveloped. The center forms a salient but the left has no natural obstacle to rest upon; and although covered by entrenchments to the front, has none to protect the flank.

However, to envelop this flank would take a long march over narrow roads through dense country. It would take a great deal of time—about 12 hours—and even if successful, it would consume most of the daylight hours of the next day, leaving little time to put on an attack and drive it home before darkness stopped the operation. The only practicable route is marked on Figure 4 by a broken line. It is rather close to the enemy position, but to take a longer route would consume much time; widely separate the Blue wings, and jeopardize completely what at best is a risky plan. A closer route to the Red position would be exceedingly hazardous, if not impossible.

What would Red be doing during these hours? The march would have to be made in close proximity to the Red line where it might easily be discovered. If during this march the Reds took the offensive Blue would be in a serious predicament. A sharp thrust forward would split the Blue force, and then Red would have the advantage of interior lines, from which he could concentrate against either Blue wing. The greater the force sent to make the envelopment, the more disastrous such a move by Red would be. However, the dense country favors concealment of the march to the flank and great results could be expected from a flank attack here, if—and that's the rub—Red is still in this position when the attack is launched and has not fallen back to a rearward position, or bent back his flank to the river, or moved some of his reserves to strike such an attack in the flank once it starts.

In undertaking such a maneuver von Liman would be making a turning movement in the presence of an enemy who is almost his equal and may very likely be his superior in strength by the time he can launch such an attack. And this enemy, besides, has given proof of his boldness of maneuver. Furthermore, we can note on Figure 4 that such a maneuver would divide the Blue army in the presence of a superior enemy. Consider this: Counting the force left at Friestadt, the portion on an independent operation under von Leffer, and the splitting

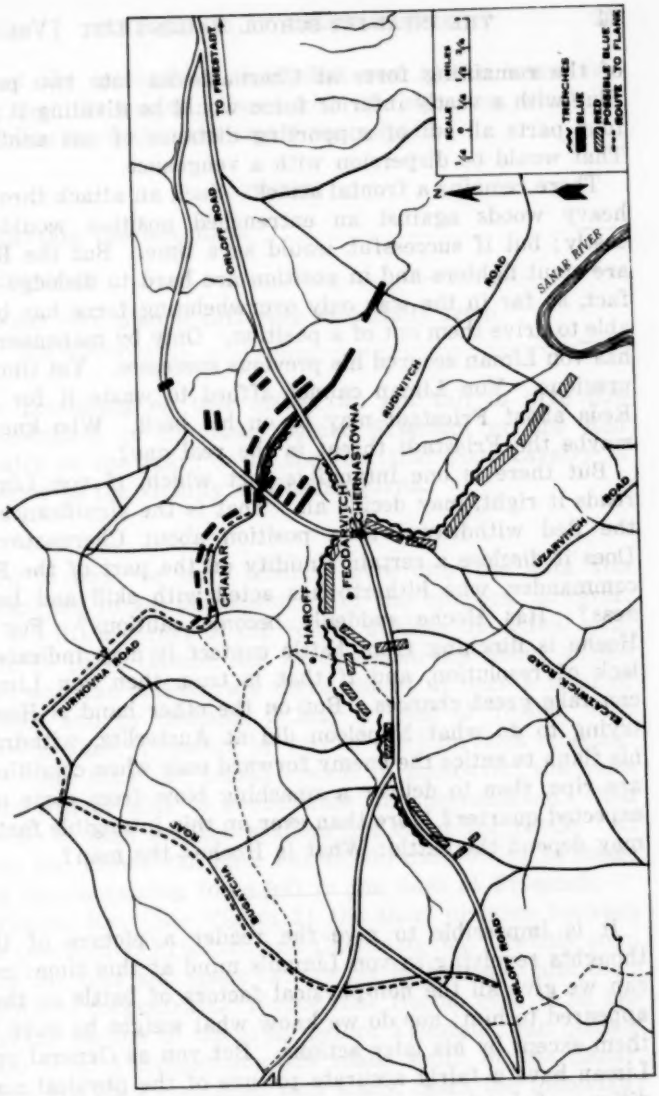


FIGURE 4.—Probable Red situation 2 May and possible Blue route to flank.

of the remaining force at Chernastovna into two parts, Blue with a vastly inferior force would be dividing it into four parts all out of supporting distance of one another. That would be dispersion with a vengeance.

There remains a frontal attack. Such an attack through heavy woods against an entrenched position would be costly; but if successful, would save time. But the Reds are stout fighters and in position are hard to dislodge—in fact, so far in the war only overwhelming force has been able to drive them out of a position. Only by maneuvering has von Liman secured his previous successes. Yet time is precious. Von Liman cannot afford to waste it for the Reds about Friestadt may be on his back. Who knows, maybe the Friestadt threat is the real one?

But there is one intangible fact which, if von Liman reads it right, may decide all. That is the significance of the Red withdrawal to a position about Chernastovna. Does it disclose a certain timidity on the part of the Red commander, who hitherto has acted with skill and boldness? Has Hoche suddenly become cautious? For if Hoche is flinching from battle contact it may indicate a lack of resolution, and if that is true, then von Liman can take great chances. But on the other hand is Hoche trying to do what Napoleon did at Austerlitz, withdraw his flank to entice the enemy forward only when conditions are ripe, then to deliver a smashing blow from some unexpected quarter? More than ever on this intangible factor may depend the battle: What is Hoche—the man?

It is impossible to give the reader a picture of the thoughts revolving in von Liman's mind at this time; nor can we give all the non-physical factors of battle as they appeared to him; nor do we know what weight he gave to them except by his later actions. But you as General von Liman have a fairly accurate picture of the physical conditions of battle, in some respects better than he had.

But of the intangibles of conflict von Liman knew far more than the reader. Faced with this situation, which of the following maneuvers would you adopt?

TEST XI

1. Envelop the left flank .....
2. Penetrate .....
3. Your own plan if differing essentially from the above .....

In pondering on this matter do not fail to give due consideration to the Reds before Friestadt or the Red Cavalry in the rear; or to the fact that your cavalry is superior in the vicinity of Chernastovna.

Up to now we have tried to give only the data von Liman had in his possession. For the moment, however, we will lift a corner of the veil to disclose the actual situation in part. Hoche has at Chernastovna about 45,000 men, and can concentrate there almost at once a total of 57,000; and by morning 2 May a total of 70,000, with more to come, if needed, by way of the Uzarvitch crossing. The more time von Liman spends in maneuver, the more Reds will be able to concentrate at Chernastovna. Red morale is high and the soldiers are eager for battle. At most von Liman can have but 48,000 men, owing to losses and the containing force left in the lines at Friestadt.

Notice, too, (See Figure 2) the short distance between the two points, Friestadt and Chernastovna. Swiftly compare the time and space factors for both armies and their ability to concentrate. Notice that Hoche, even if he has a great portion of his army before Friestadt, can quickly mass it at Chernastovna via roads south of the Sanar. When you have completed your study, check the following:

TEST XII

Would you attack at Chernastovna under these conditions?

Yes .....——

No .....——

TEST XIII

Which force has the better tactical position considering all physical factors?

Red .....——

Blue .....——

TEST XIV

Do you believe you could make a sound decision in this situation with little knowledge of the personality of your opponent?

Yes .....——

No .....——

SCHEME OF MANEUVER OF VON LIMAN

Von Liman's scheme of maneuver contemplates using the bulk of his force to make a turning movement of the enemy left, while a small containing force digs in and tries to hold the enemy in front if he attacks there. This turning movement to start at daylight May 2, involved a long flank march across the enemy front via the Furnovna-Bugatcha roads. (See Figure 4.) The heavy growth and the Red weakness of cavalry in this sector might keep this movement concealed, but it would take a long time to consummate, and if discovered at any time a Red general

attack would split the Blue army and in all probability bring on disaster.

About 4:50 AM von Johan, in charge of the movement, began his advance at the head of about 31,000 men, while von Liman took direct command of the force in front of the Reds. The march was screened by cavalry. But the movement was not to go unseen. As early as 8:00 AM the long columns moving across the front followed by artillery and trains were observed at Chanar and the movement reported to Hoche. About 11:00 AM artillery was moved into position and shelled the columns while an infantry attack was pushed forward; and though desperately resisted, the Reds advanced and engaged the tail of the turning column, not realizing, it seems, what kind of a tail it was. Thus the Blue column was split from the remainder of the army. Von Johan even had to turn back to extricate the tail of his columns, but Red did not follow up his advantage. He appeared content with the advanced position between the two wings.

TEST XV

In view of the fact that it will take a long time to complete the march (about 8 hours more) and it has thus early been discovered, should von Johan turn back?

Yes .....——

No .....——

Should von Liman order him back?

Yes .....——

No .....——

DECISION OF VON JOHAN

Von Johan continues his movement taking care to

extricate his baggage train and skillfully covering his exposed flank.

DECISION OF VON LIMAN

Von Liman does not call back his flanking force.

The small Blue force in front of the Red army put on a brisk demonstration. The sound of their guns could be heard by the turning force as it steadily marched toward its objective—the Red flank. All day long it marched until late in the afternoon it reached the flank and, apparently unseen by the Reds, formed up for the attack. The critical moment had arrived. Was Hoche prepared to receive this attack? A Blue repulse now, with the Blue wings widely separated, followed by a general Red attack, would very likely lead to the destruction of the Blue army.

At 6:00 PM the Blue attack was launched. Red for some unexplainable reason had not refused his flank here or entrenched it, despite his information of the Blue movement, and thus the full weight of the mass of the Blue army struck an unprotected wing. It crumpled completely. In a total rout the Red right corps except for a few units streamed toward Chernastovna along the road. The troops were demoralized; there was no stopping their retreat. Nightfall alone put a stop to the Blue advance but they were close to the Uzarvitch crossing road, the only remaining route to the Sanar and the south. The Blue containing force had attacked but the other portions of the Red line held stoutly.

Von Liman's daring maneuver had succeeded. Or had it? The Red defeated wing was composed of troops not of the Red race; the rest of the line had held with ease. And all night long while Blue was getting his flanking force in hand, hard fighting Red troops poured across the Sanar and took up positions for the next day. Red cavalry still held Elcazwick crossing; and on the heights of Haroff and Feodarvitch the Reds, strongly intrenched,

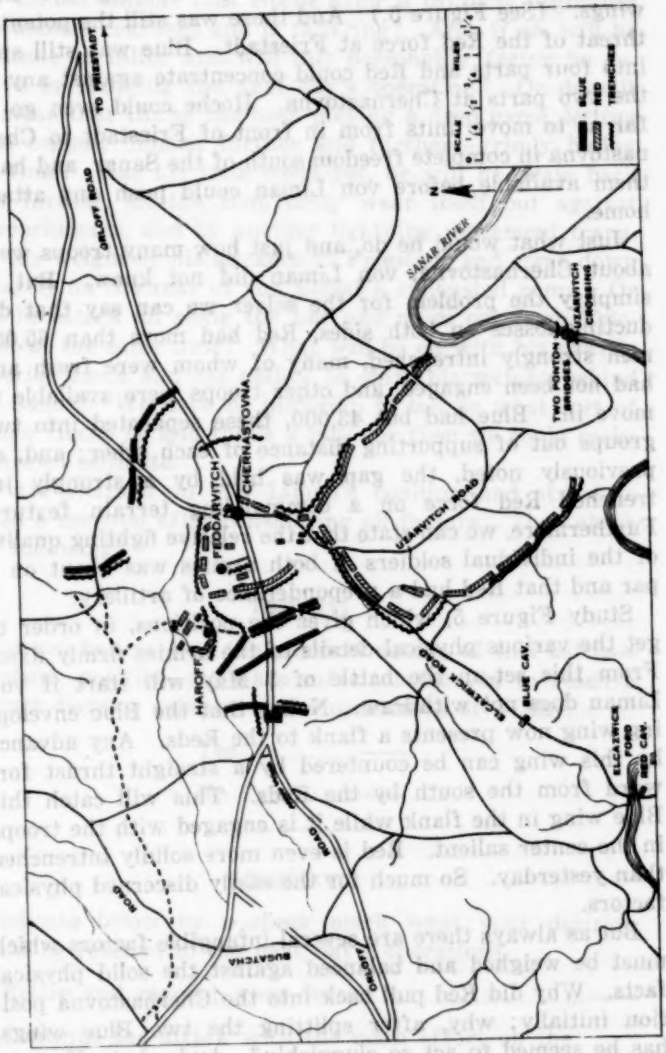


FIGURE 5.—Situation after Blue flank attack.

held a gap of two miles which separated the two Blue wings. (See Figure 5.) And there was still the potential threat of the Red force at Friestadt. Blue was still split into four parts and Red could concentrate against any of the two parts at Chernastovna. Hoche could even go so far as to move units from in front of Friestadt to Chernastovna in complete freedom south of the Sanar, and have them available before von Liman could push any attack home.

Just what would he do, and just how many troops were about Chernastovna, von Liman did not know. But to simplify the problem for the solver we can say that deducting losses on both sides, Red had more than 65,000 men strongly intrenched, many of whom were fresh and had not been engaged, and other troops were available to move in. Blue had but 43,000, these separated into two groups out of supporting distance of each other; and, as previously noted, the gap was held by a strongly intrenched Red force on a commanding terrain feature. Furthermore, we can state that the relative fighting quality of the individual soldiers of both armies was about on a par and that Red had a preponderance of artillery.

Study Figure 5, which gives the positions, in order to get the various physical details of the armies firmly fixed. From this set-up the battle of 3 May will start if von Liman does not withdraw. Notice that the Blue enveloping wing now presents a flank to the Reds. Any advance by this wing can be countered by a straight thrust forward from the south by the Reds. This will catch this Blue wing in the flank while it is engaged with the troops in the center salient. Red is even more solidly intrenched than yesterday. So much for the easily discerned physical factors.

But as always there are several intangible factors which must be weighed and balanced against the solid physical facts. Why did Red pull back into the Chernastovna position initially; why, after splitting the two Blue wings, has he seemed to act so sluggishly? And what effect on the Red army morale has the flank attack made? Can

von Liman assume that Hoche after a brilliant beginning has become confused and is faltering? And, if so, will he continue to falter and will this personality factor be decisive in planning the next day's operation? Or does it all mean that Hoche has been playing a deep game, letting Blue commit himself further and further—grimly biding his time? Has his time come yet, or will he draw back still farther, let the Blue army wear itself out against intrenchments, and by another lightning movement transfer the weight of his advance to Friestadt and come down squarely on the rear of von Liman's exhausted army. Or will he attack all along the line and move out from Friestadt at the same time? What will he do with his greatly superior force and his ability to shift his weight behind the Sanar? We have no historian to tell us what sort of a man Hoche is, and that's a pity for then we could make a shrewd estimate.

Place yourself in von Liman's position and strive to reach a decision after considering all factors. Then check the following:

TEST XVI

Do you believe that the physical details of this battle—numbers, position, etc.—are sufficient for you to reach a correct decision relative to the operations of 3 May.

Yes .....——

No .....——

TEST XVII

Indicate below by a check mark what your decision would be relative to the next day's operations.

1. Retire and regroup your forces .....——
2. Continue the attack with the main effort on the left .....——

3. Attack in some other place ..... ——

Assume that Reds are commanded by one of the following well-known generals. Check what you would do if you were General von Liman.

TEST XVIII

	Lee	*Wellington*	*Sherman*
1. Retire and regroup your forces	——	——	——
2. Continue the attack with the main effort on the left	——	——	——
3. Attack in some other place	——	——	——

In Test XVIII if you have changed the decision reached in Test XVII you have weighed the personality of the opposing commanders and permitted this factor to become a decisive element in your scheme. But again you have taken the historical estimate of a man, which, of course, no general can expect to have when he is fighting his battles. Still you do not know Hoche.

DECISION OF VON LIMAN

Von Liman decided to continue the attack on 3 May all along the line making his main effort with his left.

With 43,000 men against more than 65,000 men he attacked at dawn. The attack caught the Reds evacuating the high ground at Haroff and Feodarvitch and falling back to a new line about a mile in rear of Chernastovna. A fierce battle raged but slowly the Reds fell back or were forced back to their new position. (See Figure 6.) Here

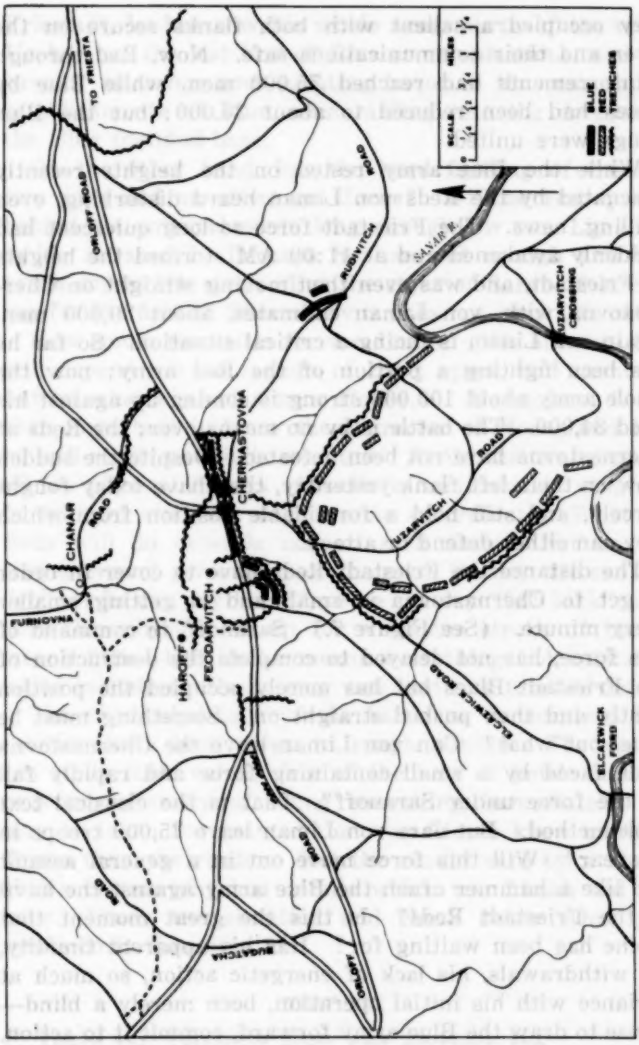


FIGURE 6.—Red position after retirement from Chernastovna.

they occupied a salient with both flanks secure on the river and their communications safe. Now, Red through reinforcements had reached 75,000 men, while Blue by losses had been reduced to about 34,000; but the Blue wings were united.

While the Blue army rested on the heights recently evacuated by the Reds von Liman heard disturbing, even chilling, news. The Friestadt force so long quiescent had suddenly awakened and at 11:00 AM stormed the heights of Friestadt, and was even then moving straight on Chernastovna with, von Liman estimates, about 30,000 men. Again von Liman is facing a critical situation. So far he has been fighting a portion of the Red army; now the whole army about 100,000 strong is coming up against his tired 34,000. The battle is by no means over; the Reds at Chernastovna have not been defeated. Despite the sudden blow on their left flank yesterday, they have today fought fiercely, and still hold a formidable position from which they can either defend or attack.

The distance the Friestadt Reds have to cover in order to get to Chernastovna is small and is getting smaller every minute. (See Figure 7.) Saranoff, in command of this force, has not delayed to complete the destruction of the Friestadt Blues but has merely occupied the position lightly and then pushed straight on. Something must be done, but what? Can von Liman leave the Chernastovna Reds faced by a small containing force and rapidly fall on the force under Saranoff? That is the classical text book method. But dare von Liman leave 75,000 troops in his rear? Will this force move out in a general assault and like a hammer crush the Blue army against the anvil of the Friestadt Reds? Is this the great moment that Hoche has been waiting for? Has his apparent timidity, his withdrawals, his lack of energetic action, so much at variance with his initial operation, been merely a blind—a ruse to draw the Blue army forward, commit it to action, wear it out, and smash it by a concentric blow? Red has the troops—in fact he has about 34,000 who have not been engaged—he has the position, he has captured the city of

Friestadt, he has now his whole army north of the river. He has cut the last line of Blue communications, and his cavalry mass has been creating havoc in the rear supply establishments of Blue, even raiding into the defense of the Blue fortified base.

On the other hand, has the hard fighting of the last two days had an effect on Hoche? Will he rest quietly behind his entrenchments long enough for von Liman to tackle Saranoff? Perhaps he has had enough and will retire across the river. But the sight of Saranoff streaking for the field of Chernastovna does not bear this out.

Now comes the crisis for von Liman. His ultimate fate will depend not on factors of time, space, and numbers, but on what kind of a man Hoche is. Heretofore, it has been important to know the character of Hoche and how he will react; now it is essential. At this critical moment all the physical factors of battle so meticulously weighted by military students must become subordinate. What the Reds will do depends not on such factors but on the character and personality of the man, Hoche. He can say "go", or he can say "hold", or he can say "fall back"; and thus this physical set-up for a master stroke of tactics means little—but Hoche means everything. A miscalculation in judging Hoche may well lead to a terrible defeat.

The physical details of the battle as to numbers and position have been given in rough outline. The reader can study them calmly free of the roar of battle and the pressing necessity of doing something immediately. It may be taken for granted that von Liman knew more of Hoche than the reader. But the reader can, by a study, obtain certain physical details which von Liman did not have. Study the situation and check below what you would do in this situation.

TEST XIX

1. Delay the Friestadt Reds and continue the attack on the Chernastovna Reds ..... ——

2. Contain the Chernastovna Reds with a small force and attack the Friestadt Reds ..... ——

3. Withdraw and await the arrival of your detached force ..... ——

DECISION OF VON LIMAN

General von Liman decides to leave a containing force before the Chernastovna Reds and attack the Friestadt Reds.

At 12:30 PM about 10,000 men move out to meet the Friestadt Reds while 25,000 remain in the lines at Chernastovna facing 75,000 Reds. The die is cast. What will Hoche do now? Von Liman cannot know that Hoche's subordinate generals are eager to go in; nor does he know of the great mass of fresh troops which Hoche has within his fortified salient. With this picture we will leave Chernastovna and march out with the Blue detachment against Saranoff.

About seven miles from Hoche's position the Blue detached force met Saranoff at Salkirch about 4:00 PM. Saranoff's column was elongated because of his eagerness to reach the field of Chernastovna. The Blue detachment in a defensive position managed to repulse the piecemeal attacks of Saranoff until nightfall.

The next morning, 4 May, the Blue force, which had lost the heights at Friestadt to Saranoff, reoccupied them and joined up with the force sent from Chernastovna. Counting the troops from all sources Blue now had 21,000 men facing Saranoff's 19,000—von Liman had overestimated this force. But Saranoff switched his communications to Barzin Ford and with his rear secure put up a stubborn fight. If he could not make any headway at least he was containing a larger force than his own, and Hoche now had only to push forward against the weak force in

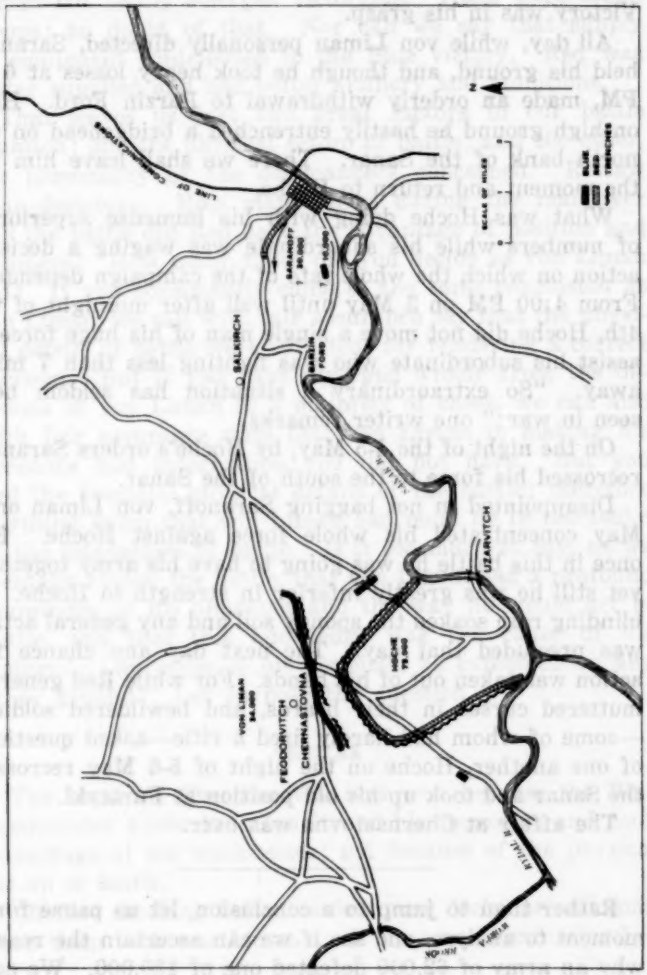


FIGURE 7.—Situation at 12:00 noon 3 May.

front of him, brush them aside with his 75,000 men, and come down on the rear of the force opposing Saranoff. Victory was in his grasp.

All day, while von Liman personally directed, Saranoff held his ground, and though he took heavy losses at 6:15 PM, made an orderly withdrawal to Barzin Ford. Here on high ground he hastily entrenched a bridgehead on the north bank of the Sanar. There we shall leave him for the moment and return to Hoche.

What was Hoche doing with his immense superiority of numbers while his subordinate was waging a decisive action on which the whole fate of the campaign depended? From 4:00 PM on 3 May until well after midnight of the 4th, Hoche did not move a single man of his huge force to assist his subordinate who was fighting less than 7 miles away. "So extraordinary a situation has seldom been seen in war:" one writer remarks.

On the night of the 4-5 May, by Hoche's orders Saranoff recrossed his force to the south of the Sanar.

Disappointed in not bagging Saranoff, von Liman on 5 May concentrated his whole force against Hoche. For once in this battle he was going to have his army together, yet still he was greatly inferior in strength to Hoche. A blinding rain soaked the spongy soil and any general action was precluded that day. The next day any chance for action was taken out of his hands. For while Red generals muttered curses in their beards, and bewildered soldiers —some of whom had hardly fired a rifle—asked questions of one another, Hoche on the night of 5-6 May recrossed the Sanar and took up his old position at Farzcyki.

The affair at Chernastovna was over.

Rather than to jump to a conclusion, let us pause for a moment to analyze, and see if we can ascertain the reason why an army of 62,000 defeated one of 130,000. We cannot say that the troops of Hoche were inferior, for troops of the same sort were gaining victories in another theater against the same foe. Later these same troops under

another commander took a harder pounding from von Liman but finally emerged victorious. These were tough troops; no doubt of that. Nor can we say that supply or equipment contributed to the Blue victory. Red was better supplied and had better artillery and munitions.

That leaves us just two great factors in our battle equation: one the physical set-up of battle; and the other, the personality of the commanders concerned. Review your decisions. How many times during the maneuver and the battle did Red have the advantage of position and numbers? How many times did you decide as von Liman did? If you consistently came to the same conclusion as von Liman, we can with fair assurance say that the physical details of battle were sufficient for rendering a correct decision. But if you have diverged widely from the decisions of von Liman in a majority of cases, we can also with fair assurance state that von Liman in making his decisions had information you did not have. But you had the essential physical details of the battle; therefore anything extra that von Liman had must lie in the realm of the intangibles of battle. Is it too much to say, as we mentally review the battle, that von Liman had a profound knowledge of his opponent and the way he would act in battle, and that this knowledge was the cause of his victory? Can some of his decisions be explained on any other ground? Let us pose the question.

TEST XX

The battle of Chernastovna was won because the Blue commander knew the capacity of his opponent and took advantage of his weaknesses; not because of the physical set-up of battle.

(Before checking below, review your decisions and compare them with von Liman's. It may be illuminating.)

Yes .....——

No .....——

But some may still be unconvinced. Someone may arise and say that von Liman was just plain lucky. He may say that in our eagerness to prove a point we have attributed the victory to von Liman's knowledge of Hoche; yet we have not proved that von Liman had this knowledge. He may add that von Liman, with such chance taking, might win one battle; but it was only a matter of time until someone came along and smashed him. Rash and lucky they would sum him up? Yet Alexander and Napoleon called for lucky generals. Still, we cannot dodge that indictment. Again we will call up the question.

TEST XXI

Von Liman won the battle of Chernastovna because he was lucky. (Think carefully, captain, before you answer this one.)

Yes .....——

No .....——

Now turn to Figure 8, page 278, and with this added data decide whether you wish to make any change in your answers to Tests XX and XXI.

The moral to this tale, if it is necessary to point one out, is this:

The personality of the general is indispensable; he is the head, he is the all of an army.

"Ah," says the still unconverted mechanistic philosopher on war, "that is but your opinion. The facts do not bear it out; and furthermore you are generalizing from a single case—very dangerous that. After all, Providence is on the side of the heaviest battalions, as one of the great captains said."

If the facts do not bear out the conclusion then it is still a matter of clashing opinions, and the above opinion was not formed at The Infantry School—though The School agrees with it. It was the opinion of a great stu-

dent of war, a man who won many battles himself. The mechanistic interpreter of war can take issue with him if he desires. His name was Napoleon.

CHAPTER 3

The Tactics Of the New Infantry Rifle Platoon

(Tentative Infantry School Teachings On the New Unit)

Various details of the new infantry regimental organization were considered in Volume XI of the Mailing List.* This chapter will try to point out how these changes affect the tactics of the rifle platoon.

We must not confuse organization with tactics. An organization is—or by all means should be—merely the best machine we can devise for putting certain tactical principles into effect. It is subsidiary to fighting. Hence our new organization is not an end in itself but a means to an end. It is born of the necessity for utilizing new weapons and accommodating infantry to new conditions; and it represents a fine balance between the requirement for mobility and agility in riflemen and the great need for supporting fires. To look upon the organization as something fixed is a serious error. It will, beyond doubt, be changed as experience and new inventions indicate a better way of combining firepower and movement. But any further change, like the present one, is almost sure to be made with a view to increasing the battalion firepower without decreasing its mobility, or to increasing both. The thoughtful officer can study the trend of development

*Chapter 1, The New Infantry Regiment; Chapter 2, Tactical Aspects of the Proposed New Regiment.

for himself with these things in mind.

In order to understand how the new battalion has become more mobile and has at the same time increased its firepower, an analysis of the firepower of newly developed weapons is necessary. The firepower of these weapons compared with that of the single-shot rifle and heavy machine gun is given in the table below. The figures given are the best available and err, if at all, on the side of conservatism:

	Firepower
Rifle	1
Semi-automatic rifle (or automatic *without* bipod)	2.5
Light machine gun (Browning automatic with bipod and hinged butt plate)	8
Heavy machine gun	20

If we substitute the semiautomatic for the rifle and a light machine gun for the Browning automatic our rifle units increase their firepower tremendously without impeding their mobility. Hence the evolution of a new type rifle battalion. However, the new rifle battalion as visualized at present, although it is smaller, and more mobile, and has a greatly increased firepower in its rifle companies, is essentially the same unit as before so far as its tactics are concerned. True it has no heavy machine guns; but heavy machine-gun supporting fire can now be obtained from the regimental commander. The battle picture will not be far different from that of the past, except that the chief concern of the battalion commander will be to capitalize on his increased mobility and firepower.

The company of three platoons will also be handled tactically as in the past. But the fact must be taken into account that it is capable of a greater volume of fire than before even though the heavy machine guns have been eliminated in order to gain greater mobility. Moreover, it now has its own light machine guns, able to keep up

with it during a rapid advance and temporarily capable of filling in until the heavy machine guns arrive, if they should be needed. From an organization thus carrying its own automatic fire along with it, we can expect more rapid maneuvering and quick powerful blows, and also a more powerful and elastic defense.

When we come to the platoon we face a different situation. Here the effects of the recent changes are indeed great. The platoon still has two sections, but there the resemblance to the old organization ends. The new section is composed of a light machine-gun squad of two guns and two rifle squads. It is a heterogeneous unit. The old section was homogeneous, with squads alike and interchangeable. But in the new section and platoon the light machine guns and rifles must be integrated and work together.

Just what method is best for utilizing these two types of weapons in one team cannot be completely answered at this early date. It will take time to determine the exact minor tactics of the section. But no infantry officer can afford to neglect, or remain unaware, of the great significance of the change that is in progress in our section and platoon fighting.

With the old platoon we could push any squad forward, or drop it in the defensive sector without thinking of its peculiar qualities, because all squads were alike. Now, we have to take notice of the difference between the squads of a section. For instance, in an attack shall we push the light machine-gun squad forward under cover of the riflemen, or shall the riflemen work forward under cover of the light machine-gun fire. Which goes first and when, and under what circumstances do the roles change? It is simple enough to say that the light machine guns will form the pivot of maneuver on which the riflemen base their advance. But such generalities are of little help to the leader on the ground. In defense, too, it is not sufficient to say that the light machine guns form the backbone of the rifle defense. The exact method, or methods, of combining the action of the light machine-gun squad

and the rifle squads under various conditions must be known before we can offer help to the leader facing a concrete situation. These methods are now being studied and worked out.

It cannot be too forcibly expressed that the ideas discussed here are subject to change as experiment goes on. These methods, doctrines, and tactics are in a state of flux. The objective of a free moving, mobile rifle battalion with great firepower is clearly visualized and the new organization has been created with that in mind. But exactly the best tactical methods for employing this new organization still awaits the test of experiment and experience. And this work may even indicate that further changes should be made in the organization. What is said here, then, is but to indicate the trend and show how the first steps are being made in the new direction.

Also, we should clearly understand that the Browning automatic rifle, as modified, is to be used as a light machine gun. Heretofore the automatic rifle has been used as a fast-shooting rifle and not as a true machine gun. This picture should not carry over into the new tactical background. The light machine gun—even the modified Browning automatic rifle—is to be used as a true machine gun. That is, it will fire automatically and in bursts.

Until the present, moreover, we seldom left the task of combining rifle and machine-gun fire to any commander lower than the battalion. Now we have entrusted this duty to the commanders of platoons and sections. This is significant, for the great mass of our firepower in the new regiment is in these light machine guns. To realize on their potential power all infantry personnel must know how to use them properly and in conjunction with the riflemen. We have not merely added a new weapon but tend to modify the tactics of platoon and section fighting.

Since the great defensive power of machine guns is well known it may be well to go into some detail regarding the method of using the new platoon with its light machine guns in a defensive situation. To discuss the use of the

platoon in the attack as well, would be too great to include in this chapter. This subject, therefore, will be left for a later issue of the Mailing List. At this time then we shall consider only the tactics of the new platoon in a defensive situation, and we shall do this from the platoon leader's viewpoint.

In the reconnaissance of his defensive sector the platoon leader, as in the past, still looks for the keypoints and the natural obstacles that strengthen his sector; the logical enemy approaches toward his position; the field of fire available to himself; and the dead spaces across the front and flanks of his position. He considers every small rise—even a large bump—of the ground, which, as tactical localities, are suitable for riflemen, light machine guns, or both. He seeks especially for locations that will permit flanking fire by his light machine guns, and for suitable sectors of fire and final protective lines for these guns. He carefully checks all available cover and concealment.

Before finally deciding upon his dispositions, a platoon leader must study several other items. What areas can be defended by fire; what must be occupied by men? Can the keypoints be defended by blocking the approaches, or must elements of the platoon actually be deployed upon these points? How many avenues of approach are available to the enemy; and which of these constitutes the primary fire missions of the platoon? Shall the light machine guns be located singly or in pairs; shall each have a separate sector of fire; or shall the firing sectors overlap, or shall two or more guns use the same firing sector?

Which light machine-gun locations will give the most effective flanking fire; which will support neighboring combat groups, and at the same time block the approaches to the platoon positions? How can a final protective line be established with the light machine guns? Where must the riflemen be disposed so as to protect the light machine guns, and at the same time be able to fire missions of their own? How must heavy machine guns and antitank weapons be protected, if these are near-by? Should fields

of fire be widened or deepened by additional clearing? How can maximum advantage be taken of natural obstacles? Do these obstacles offer cover and concealment to the enemy and thus the chance for surprise? How can dead spaces about the combat group, not covered by artillery or mortar fire, be minimized in area? How can the little groups within the occupied area give support to each other? What dispositions will facilitate communication and movement within the occupied area and how can the section leaders best exercise control of the defense?

These questions give the leader of the new type platoon a great deal to think about; he will have many decisions to make.

In deciding these questions a platoon leader must clearly visualize his primary fire missions, and then assign these primary missions to his light machine guns. His riflemen then have a dual mission—they must fire all missions not fired by the light machine guns, and must also protect the light machine guns. Both missions are equally important.

Thus it is plain enough that the inclusion of light machine guns in the platoon produces a more complicated, if more efficient, platoon defensive organization. The basis of the platoon defense is the light machine guns; they fire the primary missions. But just how are these guns to be used, and how must the riflemen be articulated with them?

In defense there are three general ways of employing the light machine guns. These are: (a) light machine guns emplaced in pairs; both guns in each pair having the same mission; (b) machine guns emplaced in pairs but sited so as to fire overlapping missions; (c) guns employed so as to fire separate missions.

In Figure 9, the light machine guns are emplaced in pairs. Both guns in each pair have the same mission.

The advantages of this first method are that a heavy volume of fire can be kept up on two important primary missions; control is simple within the gun squad, but fewer final protective fires will usually be possible than in cases 2 and 3. The disadvantages are that it restricts the areas over which machine-gun fire can be maintained; it

requires the 24 riflemen to distribute their fire over large secondary missions; and it gives the least effective distribution of fire over the sector; it makes control of the riflemen's fire difficult; and permits usually, on normal

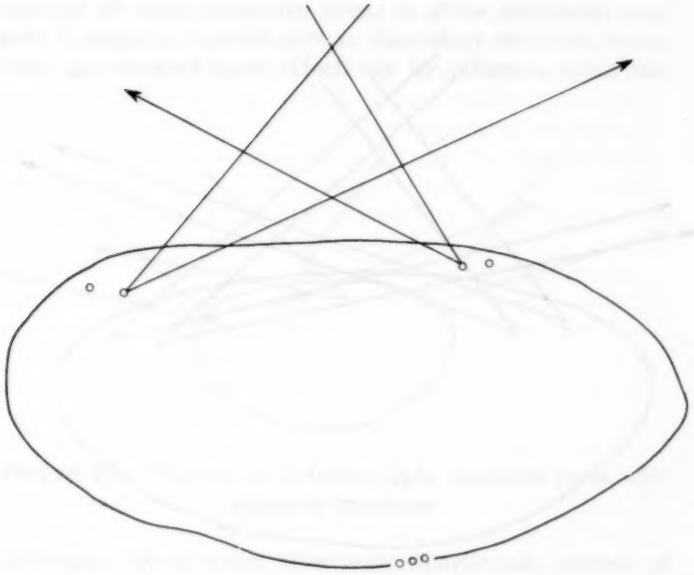


FIGURE 9.—Platoon in defense; light machine guns in pairs. Both guns in each pair have the same mission.

terrain, the minimum of fire support to adjacent combat groups.

The second general way of using the light machine guns is indicated in Figure 10. Here the machine guns are emplaced in pairs but are sited on overlapping missions.

This method has the following advantages. A greater number of important primary fire missions are initially covered; there is a more even distribution of light machine-gun fire; more final protective fires can be maintained; it

is more favorable for giving greater fire support to adjacent combat groups; the fire of the riflemen is distributed over smaller areas, thus making it easier to control their fire. Its disadvantages are, however, that it is harder for the light machine-gun corporal to exercise fire control; the method may require a light machine gun to be moved

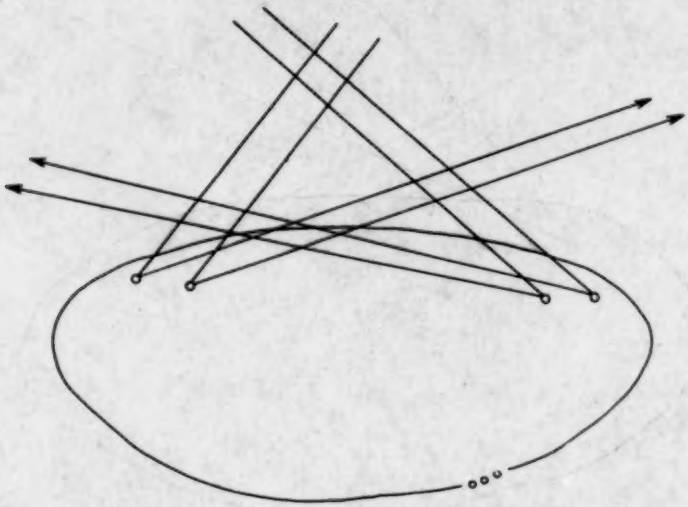


FIGURE 10.—Platoon in defense; light machine guns sited in pairs on overlapping missions.

when movement is difficult but the necessity vital; a mechanical failure or a direct hit may stop a vital protective fire at a critical moment; and there is still, as in the first method, an uneven distribution of fire over the platoon sector.

In Figure 11, we see the third method of using our light machine guns. Here the guns are emplaced singly and on separate missions. (However, in certain cases it is

recognized that the guns, or perhaps a pair of guns, can be placed in pairs and still fire separate missions.)

The advantages of this method are that it covers the greatest possible number of primary missions by light machine-gun fire; it obtains the most effective distribution of light machine-gun fires; it provides the greatest number of final protective fires; it gives maximum support to adjacent combat groups. Secondary missions, moreover, are covered most effectively by riflemen, since machine-gun fire is more effectively distributed; control of the riflemen's fire is simplified since the riflemen are not spread out to cover a large number of missions; and maximum protection is assured to the light machine guns, since a light machine-gun and a rifle squad can generally be located together as a combat team. Maximum flexibility of the fires of the platoon is procured. The main disadvantages are that it increases the difficulty of fire control of the light machine guns; requires that the light machine guns generally must be emplaced farther apart in order to accomplish their missions; may require moving a light machine gun when such a shift is difficult, but the necessity vital, as when a mechanical failure or direct hit puts a gun out of action so that an important approach

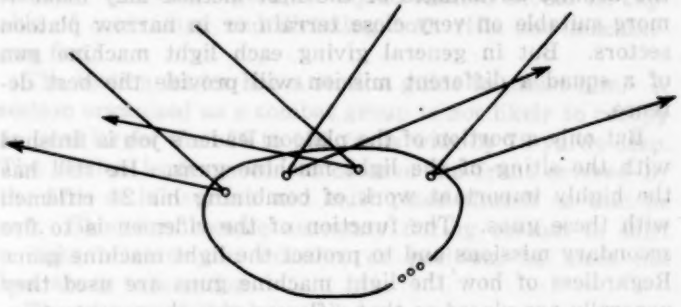


FIGURE 11.—Platoon in defense; light machine guns with separate missions.

remains covered only by the fire of riflemen at an inopportune time, thus creating a dangerous gap in final protective fires when it is least desired.

Regardless of the disadvantages of the second and third methods, it is obvious that one or the other of these generally offers the best solution. What we want is maximum distribution of fire, flexibility, and teamwork between the light machine-gun squads and the rifle squad. The terrain and frontages will dictate always, of course, which method should be used. Despite certain disadvantages, the definite advantages of the first method may make it more suitable on very close terrain or in narrow platoon sectors. But in general giving each light machine gun of a squad a different mission will provide the best defense.

But only a portion of the platoon leader's job is finished with the siting of the light machine guns. He still has the highly important work of combining his 24 riflemen with these guns. The function of the riflemen is to fire secondary missions and to protect the light machine guns. Regardless of how the light machine guns are used they generally are placed so that riflemen give them protection.

When the platoon leader has solved his immediate problem, he confers with leaders of units to his right and left. He settles with them the responsibility for defending the ground between his and adjacent combat groups, and arranges for the coordination of fires. This accomplished, he is ready to place his platoon upon the position and begin organizing the ground. Later these arrangements will be checked by the company and battalion commanders concerned.

What kind of field fortification, we must next consider, will the light machine gunner want? At present his gun is on a bipod mount and can easily be shifted. The gunner will have a sector of fire and a final protective mission. He must be prepared, however, to shift his fire to either flank if necessary. Therefore he should be located in a fox hole or individual rifle pit. A man can dig such a position in three-quarters of an hour, a position similar

to that a rifleman prepares. So similar, in fact, that any fox hole could be readily occupied by any light machine gunner. Time permitting, these pits are connected with a trench.

The defense of the platoon organized area will be difficult to control. To help him in handling his light machine guns, ammunition carriers, and riflemen, a platoon leader has a platoon sergeant, two runners, (with a third at company headquarters) two section leaders, two section guides, and four rifle and two light machine-gun squad leaders. (In this regard, all squad leaders should be capable of controlling and directing both rifle and machine-gun fire.)

The section leader has a section guide to assist him. A section organized as a combat group is not likely to occupy an area larger than 75 to 100 yards wide by 75 yards deep. The section leader needs to observe the front covered by the fires of his section and must place himself so that he can. Should it become necessary during combat to shift a light machine-gun mission, or position, he must not hesitate to take action.

The platoon leader has a platoon sergeant and two runners at his command post. He cannot control and supervise his platoon by staying there, since it will usually occupy an area about 150 yards to 200 yards wide and 75 yards deep. Therefore, he must continually visit his sections. He must also continually plan ahead, deciding how and where he will move his squads to meet the varying developments of battle.

Here we must remember the undesirability, in the defense, of moving men from shelter out into the open to fight.

Hence there is a necessity for supplementary positions within combat groups from which fire can be brought to bear to flank and rear. These supplementary positions permit all around defense, and due to the flexibility of fires thereby possible, they enable a unit to limit hostile penetration. But where should they be placed and how many are needed?

The first study of the ground, upon which the platoon leader bases his organization of it, determines where the supplementary positions should be. Areas to the flank and rear of a combat group, areas that may furnish cover and concealment to an attacking enemy, are particularly dangerous. Unless these are covered by adjacent groups or taken care of in the initial organization of fires, supplemental positions to which light machine guns and riflemen can be moved, must be placed to cover them.

One other important thing it is necessary to consider. The great firepower of the new platoon organization means a rapid consumption of ammunition. Hence, extra grenades and ammunition should be distributed to all prepared positions, occupied and supplementary. A small reserve should be held at the command post for emergencies.

Let us now make a brief summary of the tactical doctrine of the new infantry platoon.

(1) A combat group should be organized for all around defense. This may necessitate supplementary positions for each light machine gun, and each rifle squad.

(2) Mutual support between the squads within the combat groups, and with adjacent combat groups, must be arranged.

(3) The riflemen fire secondary missions and protect the light machine guns.

(4) Light machine-gun missions are first coordinated within the platoon, and then within the company and battalion.

(5) Light machine-gun missions may ultimately be coordinated with those of heavy machine guns. This coordination is made through the battalion commander.

(6) It is best for the platoon leader to arrange his own defenses, and to expect that the heavy machine guns will amplify the defenses he has planned.

CHAPTER 4

The New Rifle Platoon In Defense

(An Illustration of the Tentative Infantry School Teaching On the New Unit)

SITUATION

A Blue company, as part of a larger force, under protection of a covering force to the front, is taking up a defensive position facing generally southwest. (See Figure 12.) From present indications an attack upon the position is not expected before daylight day after tomorrow. It is now 2:00 PM, January 31st.

Your platoon, 1st Platoon Company B, has been ordered to organize and prepare for all around defense a combat group as indicated in Figure 12. So much of the plan for the organization and defense of the company sector and adjacent sectors, as is known to you, is indicated on the situation map.

You are further informed: that the keypoint in the battalion sector is hill *661*; that your position must be defended to the last; that the battalion plan included the possible use of Company C (now organizing the battalion reserve line) in a counterattack to recover hill *661* from the stream about 200 yards northwest of the combat group of the 3d Platoon Company B, that the normal barrage of one battery of artillery and the normal barrage of one mortar will be placed on the west edge of the woods in your sector as indicated in Figure 12.

Figure 13 (in back of the book) shows in greater detail the ground in the vicinity of your combat group. The area

is pasture land. Woods are well kept with a scattering of underbrush. Ground visibility through the trees is limited to about 100 yards. A few scattered evergreen trees can be seen in the woods. The weather is cold and clear.

Your platoon is at full war strength and all are present. You have one runner at the command post. Engineer tools have been dumped by the side of the road at RJ 607-B. (See Figure 12.)

REQUIREMENTS

a. Initial battle positions and primary missions of the light machine guns.

b. Initial battle positions and missions of the rifle squads.

c. Battle position of platoon commander, platoon sergeant, and section leaders.

d. Protection provided for the antitank gun located in the woods near the platoon.

e. One supplementary position for each light machine gun.

f. One supplementary position for each rifle squad.

g. Disposition of reserve ammunition dumped on the position.

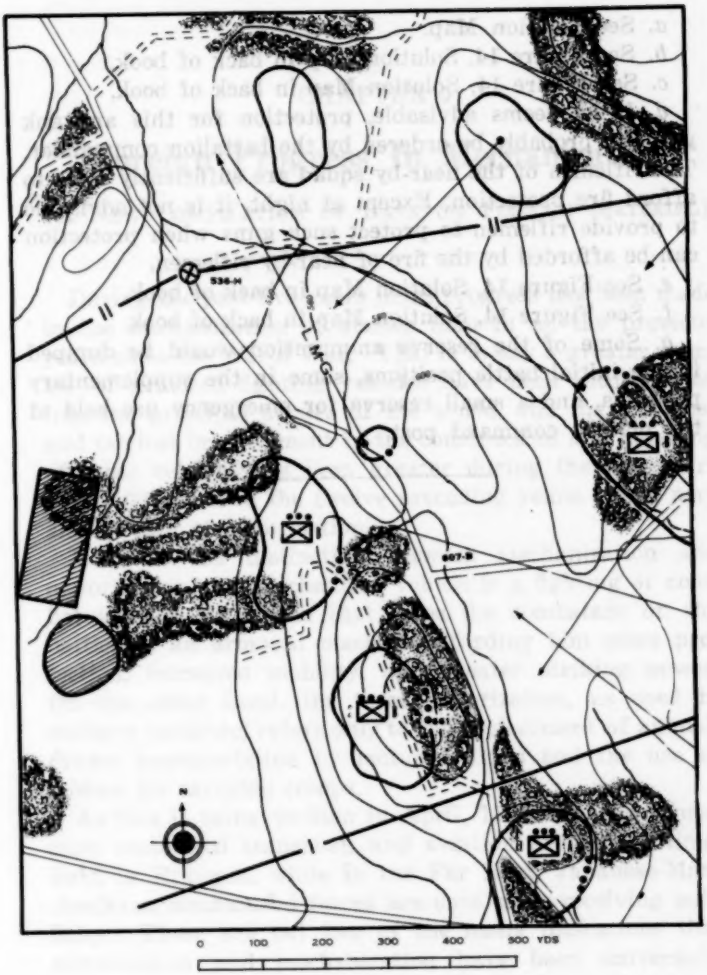


FIGURE 12.—Company defensive sector.

A SOLUTION OF REQUIREMENTS

a. See Solution Map.

b. See Figure 14, Solution Map in back of book.

c. See Figure 14, Solution Map in back of book.

d. If he deems advisable, protection for this antitank gun will probably be ordered by the battalion commander. The riflemen of the near-by squad are sufficiently close to afford fire protection. Except at night, it is not advisable to provide riflemen to protect such guns when protection can be afforded by the fire of near-by riflemen.

e. See Figure 14, Solution Map in back of book.

f. See Figure 14, Solution Map in back of book.

g. Some of the reserve ammunition would be dumped in the initial battle positions, some in the supplementary positions, and a small reserve for emergency use held at the platoon command post.

CHAPTER 5

Foreign Progress In Mechanization

(A New Compilation of Data on Foreign Materiel)

During the past five years more progress has been made in the mechanization of armies than in all the previous years since the World War. That is to say a greater number of armored fighting vehicles have been incorporated into the principal armies of the world, and the technical and tactical improvement in the construction and handling of these vehicles has been greater during the five years since 1930 than in the twelve preceding years. This may also be said of motorization.

What is the distinction between mechanization and motorization? A mechanized vehicle is a fighting or combat vehicle. It is one that gives the combatant on the battlefield an armored machine affording him more protection, increased mobility, and greater striking power. On the other hand, the term motorization, as used in military parlance, refers only to the replacement of animal-drawn transportation by motor vehicles and the use of motors for carrying troops.

As this is being written in April, 1936, tanks, armored cars, motorized transport, and aviation are in the limelight in Ethiopia, while in the Far East, Japanese-Manchoukuan mechanized forces are once more receiving publicity. These are but two of the many indications that motorization and mechanization have been universally accepted and are here to stay. All armies are trying, within financial restrictions, to keep abreast of mechanical

progress. Our Regular Army and National Guard are both being rapidly motorized. So too are foreign armies. And foreign armies are also being rapidly mechanized—far more rapidly, in fact, than our Army. How far this mechanization is being carried, what technical development is taking place, and what leading countries think about tank employment—these are the topics surveyed in the pages that follow. The statements made and statistics presented cannot, of course, be guaranteed wholly correct. Yet they are based on comments and data published in military periodicals and the works of leading writers in the field of military mechanization, and if they err it is on the conservative side.

This study is confined almost entirely to the tank side of mechanization and makes only occasional comments on armored cars merely to bring out the relationship existing between these two main classes of combat vehicles—the one essentially a track-laying cross-country vehicle and the other a wheeled, road vehicle. Moreover, these, it must be understood, are purely arbitrary divisions because many convertible vehicles exist possessing the characteristics of both armored cars and tanks, such as, the Christie, the Landsverk, and the Vickers Convertible.

TECHNICAL DEVELOPMENT

Before examining the technical development of tanks it is well to note how the French and British, who built and used tanks during the last war, look upon tanks in their scheme of national defense. These two nations are still leading in tank development, although Russia, Italy, Japan, Germany, and Poland, in the order named, follow close on their heels, both in quantity and quality. Russia, indeed, is already leading in number of tanks in service. Hence we shall try to present the tank ideas of these other countries too, in so far as they are known or can be deduced.

The views of the French and the British upon employment, and therefore upon design of combat vehicles, are

far from similar, largely because of their divergent problems with regard to possible future war.

The French are primarily concerned with their eastern frontier in Europe and are less perturbed about their colonial frontiers. They have built permanent defenses and organized their army in preparation for a struggle with an adversary as well equipped as themselves with whom they will have to fight in a limited area giving but few opportunities for extensive maneuvering or deep thrusts.

Great Britain, however, has no contiguous borders; and her navy and air force, rather than fortified frontiers and masses of ground troops, are the first line of home defense against foreign attack. The probable tasks to be performed by the British Army are, therefore, in their most likely order of occurrence—

(a) Support of the civil administration, of which recent actions in India, Palestine, and Cyprus are examples.

(b) Small wars, including defense of frontiers, such as the operations in Tirah in 1931.

(c) Continental warfare, probably as an ally of one or more other powers.

(d) Home defense.

Colonial warfare consists of combat in wide areas against native forces which are usually superior in numbers but inferior in equipment and auxiliary weapons. For such fighting the armored vehicle—tank or car—is excellent, and it can operate with little fear of destruction by enemy fire because artillery and antitank guns are almost totally lacking among the natives.

Though the French also have vast colonial domains—protectorates and mandates—they seem to give less thought to them than the British in their army organization and equipment. This is noticeably apparent in the tanks found in the two armies, as we shall see presently.

In tanks as in battleships, a compromise must be made in design to satisfy four conflicting factors; namely, armament, armor protection, speed, and radius of action. Over-emphasis of either of the first two items, or both,

means a reduction in the last two. Similarly, if it is desired to increase speed or radius of action, then the armor, and probably armament too, must be lightened. Associated with these size and weight factors is the classification of heavy, medium, light, and ultra-light tanks. These can be considered to mean over 25 tons for heavies, 10 to 25 for medium, 4 to 10 for lights, and under four tons for ultra-light tanks (usually 1.5-3 tons). In many countries

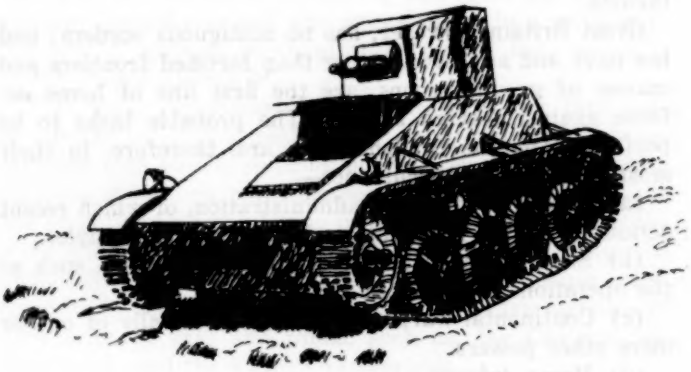


FIGURE 15.—Vickers-Carden-Loyd 1933.

this latter term is not used, a light tank being any one weighing under eight or ten tons. Thus the Vickers-Carden-Loyd Model 1933 weighing 3.8 tons is classed as a light tank. The ultra-light tanks are usually known, however, as tankettes, machine-gun carriers, patrol tanks, and *chenillettes*. (The French also call them "maids of all work" because they can perform so many different tasks.) The Germans call the ultra-light tank, *kleinkampfwagen*, and the light tank, as we do, *leichte kampfwagen*.

These types are further broken into two great divisions, slow and fast tanks. All World War tanks were slow, and when the term "slow" is used it generally refers to World War tanks. The highest speed obtainable from the fastest

was seven miles per hour. But these are now obsolete, or at least obsolescent in countries where they are continued in service, France being the one World War belligerent that still has a large quantity of outmoded tanks in use. Even the French D tank (101 tons) of today can go ten miles an hour. *Slow* and *fast*, as applied to tanks, except in referring to antiquated types, is now a relative term with no specific meaning. Twelve miles per hour might be taken as the dividing line between slow and fast tanks. This is a purely arbitrary figure, however, and really of

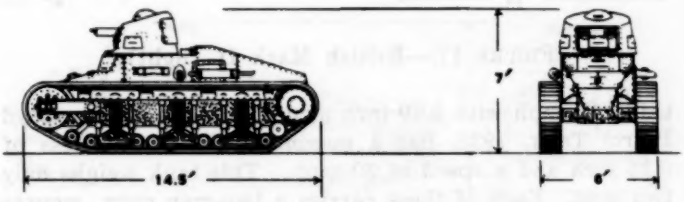


FIGURE 16.—French Renault NC 2.

little importance.

Having seen this classification of our land fleet into ships-of-the-line (heavy and medium tanks), cruisers (mediums and lights), and destroyers and patrol boats (lights and tankettes), and also its division into the superannuated and the modern types, we can now return to our study of French and British tank development. At the expense of mobility, France definitely favors armor and armament, which is in keeping with her general scheme of frontier defense. As a result her heavy tanks have a maximum armor thickness of 50-mm, her mediums 35-mm, and her light tanks 22-34-mm; or roughly 2.0 inches, 1.3 inches, and from 0.85 inches to 1.3 inches. France too has tankettes or *chenillettes*. In them speed (20-25 mph) has been allowed to supplant heavy armor. Except for these baby tanks, France carries the heavily armored battleship idea right down to her light tanks, which have, as a result, much less speed than the British tanks.

The British, on the other hand, have built light, fast cruisers or destroyers. Their Vickers-Carden-Loyd, 1933, 4-ton tank has a speed of 30 mph with 0.35 inch armor; the Mk. IA, 1931-32, (4.75 tons) has the same speed with 0.59 inch armor; the Mk. II and IIA, 1932, (3.6 tons) can

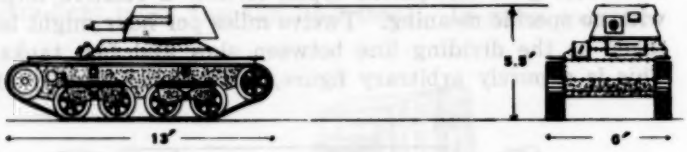


FIGURE 17.—British Mark II (light).

travel 35 mph with 0.59 inch armor; and the Carden-Loyd Patrol Tank, 1932, has a maximum armor thickness of 0.35 inch and a speed of 30 mph. This tank weighs only two tons. Each of these carries a two-man crew, mounts

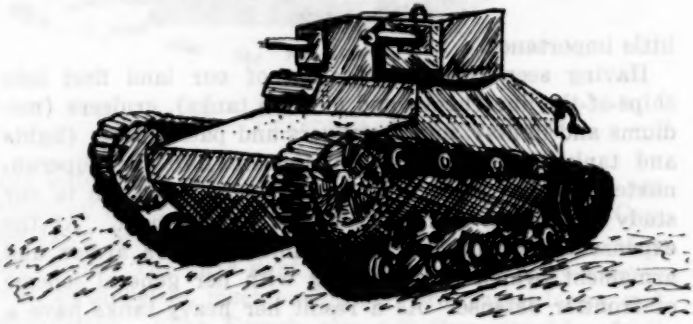


FIGURE 18.—Vickers-Armstrong 6-ton (B).

one machine gun and can operate more than 100 miles on one gasoline refill.

The Vickers-Armstrong 6-ton tank (1930 and 1931) carries three men and two machine guns (or a 47-mm gun and one machine gun), and, with no heavier armor than

0.59 inch, makes 21 mph.

British medium tanks have advanced more slowly than the light tanks. Best of these is the Vickers-Armstrong 16-ton, Model of 1929. It carries a crew of six men and has a small cannon and three machine guns. With a maximum armor thickness of 1.0 inch, its 200 H.P. motor drives it 30 mph.

Only two experimental vehicles in the heavy tank field have been made in England since 1918.

At present, an effort is being made in Great Britain to produce a satisfactory vehicle for use as a close-accom-

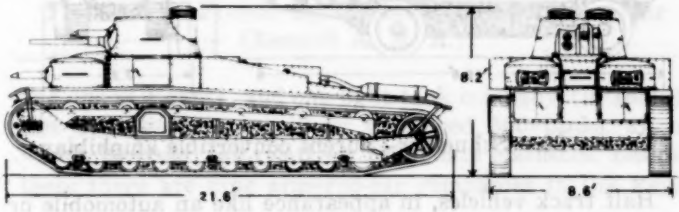


FIGURE 19.—Vickers-Armstrong 16-ton.

panying tank—an infantry support tank. This "I" tank or army tank, as it is called, will probably be slower than other modern designs but will carry heavy enough armor to stop at least the armor-piercing bullets of small caliber antitank guns.

Both England and France have built amphibian tanks, among which the Vickers-Carden-Loyd of 1931 weighing 3½ tons is a good example. It will go 6 mph in the water and 30 mph on land. The French Schneider-Laurent wheel-track-amphibian goes 10 mph in water, 18 mph on tracks, and 28 mph on wheels.

Two support tanks each armed with a mortar or howitzer are a part of each tank company in the Royal Tank Corps.

The light and ultra-light types have been constructed with suitable superstructures for use as towing vehicles. They are used mainly to pull guns, and ammunition and

supply vehicles.

France and England have both made much progress in armored car development. Here too the French use heavier armor than the British, placing their faith in armor for protection whereas across the Channel, speed is largely relied upon.

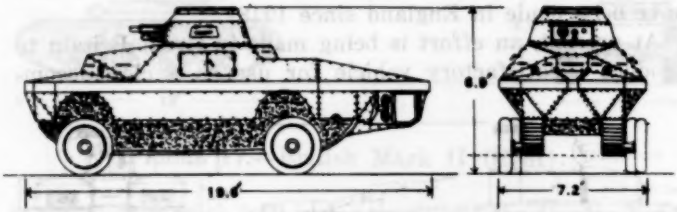


FIGURE 20.—Schneider-Laurent convertible amphibian.

Half track vehicles, in appearance like an automobile or truck, but with a four-, five-, or six-foot length of track replacing the rear driving wheels or each side, are also among the cross-country machines. This arrangement is found more in the French Army than in the British, and

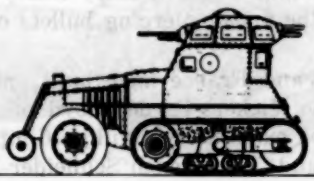


FIGURE 21.—French half-track armored car.

is especially liked for armored cars because it adds greatly to cross-country mobility. Its disadvantages, like those of all track constructions, are less speed, less gasoline mileage, and shorter life than is obtained with wheeled and tired vehicles.

Of medium, light, and tankette types, France is said to have 3,000 tanks, of which more than two-thirds are left-overs of the War. Great Britain now has a tank brigade of four battalions, two separate battalions (one at home

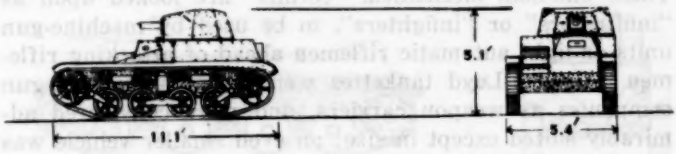


FIGURE 22.—French light reconnoitering combat car (Renault A. M. R.).

and one in Egypt), and one light tank company (in India). The aggregate is not likely to exceed 500 tanks, all of which, however, are relatively up-to-date machines. Besides these there are nine armored-car companies in the Royal

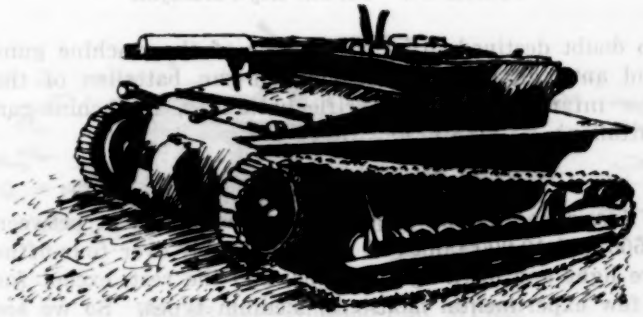


FIGURE 23.—Carden-Loyd Mark VI machine-gun carrier.

Tank Corps. Seven companies are in India and two in Egypt. The mechanizing of a cavalry division in England and a cavalry brigade in Egypt, which is now being carried out, will increase the total number of tanks by two battalions, and the armored cars by several companies.

Several attempts to build a practical one-man tank or machine-gun carrier have also been made in England. Hints in military periodicals indicate that tests are now being made of one that is much smaller and much less conspicuous than the Carden-Loyd two-man tankette. These one-man mechanical "coffins" are looked upon as "infiltrators" or "infighters", to be used by machine-gun units or light automatic riflemen ahead of attacking riflemen. Carden-Loyd tankettes were used in machine-gun companies as weapon carriers, and were considered admirably suited except in size; an even smaller vehicle was wanted. This latest development, being inconspicuous, is

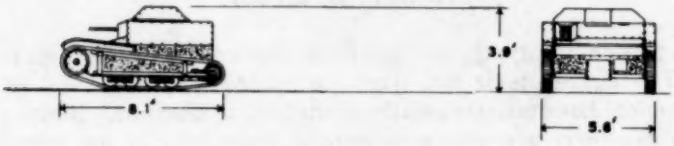


FIGURE 24.—Carden-Loyd-Russjik.

no doubt destined to be the carrier of the machine guns and antitank guns of the machine-gun battalion of the new infantry brigade (3 rifle battalions, 1 machine-gun battalion).

Russia has a tank fleet variously estimated at between 3,500 and 10,000 tanks, of which probably over four-fifths are light and ultra-light designs, and the rest, except for a few experimental monsters, medium types. So we see that Russia follows England rather than France, which is understandable when her vast country and gigantic frontiers are taken into consideration. Similarly, Poland, her next door neighbor, with wide plains and extensive forests inclosed in her 3,000 mile frontier, leans toward light, fast combat vehicles. Both of these countries have purchased large numbers of Carden Loyd tankettes. Russia is able today, thanks to her industrial development, to

build her own tanks patterned after French Renault, British Carden-Loyd, and Vickers-Armstrong, and American Christie designs. Of Christie design Russia has about 600 tanks.

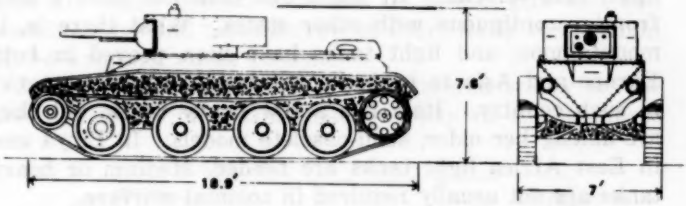


FIGURE 25.—Russian Christie fast tank.

Italy's latest tanks are the 3-ton Ansaldo-Fiats, M. 1933, which are patterned after the Carden-Loyd. Character-

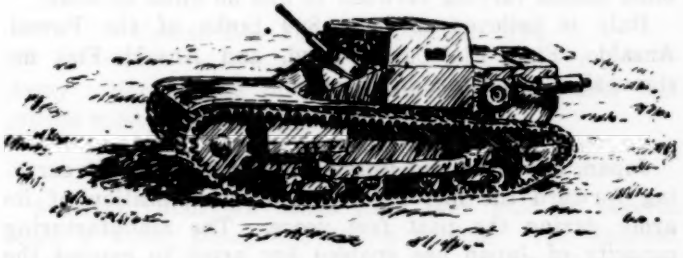


FIGURE 26.—Ansaldo-Fiat M1933.

istics are: 2-man crew, one machine gun, heaviest armor 0.35 inch, maximum speed 25 mph, 9 feet long, 4½ feet wide, less than 4 feet high. This tank has experienced a few mechanical difficulties, but on the whole has per-

formed fairly well in Ethiopia especially with General Graziani's mechanized force on the southern front where desert plains rather than precipitous mountains were crossed.

It may be said that Italy is another of the advocates of light, fast vehicles. At home she does not have a long frontier contiguous with other states. What there is, is mountainous, and light tanks have been proved in both Europe and Asia to be more suitable than medium tanks in such country. Italy has a few heavy tanks, but they are among her older, semi-obsolete models. In Libya and in East Africa light tanks are needed. Medium or heavy tanks are not usually required in colonial warfare.

A design that has been used experimentally in tanks and also in tractors is the Pavesi four-wheeled chassis, which has wheels like the large, flat, and broad, grousered wheels of many American farm tractors. Different models of this design vary in weight from four to eight tons, carry from two to four men, mount one, two, or three machine guns, use relatively light (8-16mm) armor, and have maximum speeds varying between 12 and 30 miles an hour.

Italy is believed to have 800 tanks of the Pavesi, Ansaldo, Fiat, Fiat-Carden-Loyd, and Ansaldo-Fiat designs, all of which are light tanks.

Japan, like Italy and Russia, has been feverishly carrying forward the motorization and mechanization of its army during the past few years. The manufacturing capacity of Japan has enabled her army to expand the small force of a scant 100 tanks of semi-obsolete foreign construction, which existed in 1931, into three regiments having close to 1,000 tanks. About one-fifth of these are foreign built, and include many different designs, notably French Renaults, British Whippet A's, French St. Chamonds, British Carden-Loyds, and British 6-ton Vickers, of which all but the last two are now considered obsolescent or obsolete. Japanese-built tanks are of four main types:

the light "92" (31 mph.), patterned after the Carden-Loyd tankette, and the light "93" (7-ton); an 8-ton Etsu "B" tank, similar to the Renault N. C. 27, which carries a light cannon and one machine gun with a two-man crew; a 10-ton model "89", copied from the Vickers Mk. C. of 1926-27, which mounts a 37-mm or 57-mm gun and two machine guns and takes a crew of four; lastly the medium M. 94 weighing about 16 tons.

Armored cars—and even a few armored trolley cars—are also found in considerable quantity in the Japanese

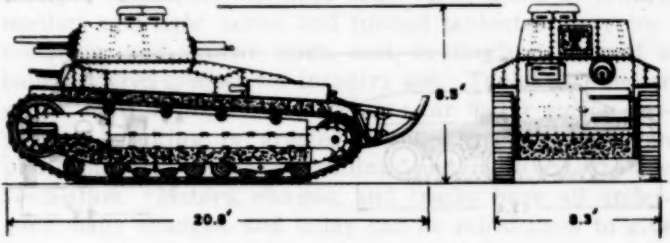


FIGURE 27.—Japanese Medium M94.

Army. For service in Manchuria the 3-ton tank has proved most useful.

Swedish Landsverk tanks have been built in several sizes, a 4-ton, 6-ton, and 10-ton vehicle. The smallest carries a crew of two, the larger one a crew of three, and the 10-ton a crew of four, with one, two, and three guns respectively. Maximum speeds range from 25 to 35 mph, with 45 mph possible in the convertible 10-ton tank when operating on wheels (retracting arrangement changeable in 28 seconds). Light armor is used. An interesting feature is the number of speeds available, five or six forward and two in reverse. This is found in many European-made tanks where smaller engines are used, making greater gear reductions necessary.

In many armored cars, such as the Czechoslovakian "Skoda", provision is made for steering either forward or backward, and for traveling as fast in reverse as in forward gears.

Germany has been left to the last in this discussion of designs because she came last into the march of mechanization and also because we know least about her development of tanks. All the pictures seen in newspapers and other periodicals show light and medium tanks. These are believed to be patterned after the highly praised,

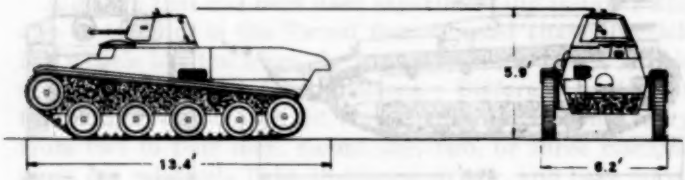


FIGURE 28.—Landsverk 100 (1934).

Swedish Landsverk tanks, some of which they resemble in appearance. German engineers are said to have worked in the Swedish plants devoted to tank manufacture during the years since the World War. And it is well known that German engineers, like American engineers, were employed by the Soviets in their vast industrial development. It is therefore highly probable that German tanks of today combine the best features found in Swedish tanks, as well as in British, French, and the American Christie designs. Recent press estimates credit the German army with 1,000 light tanks. They appear to be about 8-ton vehicles.

What do tanks cost? In quantity production, about $100,000 for a heavy tank like the French (70-ton) 2C, $25,000 for a medium like the British 16-ton, and $5,000

for a light tank, such as the British 4-ton Vickers-Carden-Loyd. Or, it might be put, about seventy cents a pound. Or, as General Von Eimansburger significantly expresses it in his "Kampfwagenskrieg" (Mechanized War)—at the cost of 4,000 shells for a heavy, 1,000 for a medium, and 200 for a light tank.

Aside from the great increase in speed, which will probably not exceed 15-20 mph in combat, it is interesting to note the many details in tank design that have been changed and improved since 1918. The trend is toward medium and light tanks, and toward tankettes for reconnoitering, and similar work, and, in England, toward a baby armored creeper for infantry use. Tanks have better armor with no increase in weight; far better spring suspension resulting in greater mobility, more stable gun platforms, and also easier riding; and more satisfactory ventilation. Motors, chassis, and tracks have all undergone many changes, and today can be relied upon to give not several miles of fair performance, but many hundred miles of excellent performance. Aircraft engines and Diesel engines are being used in many of the latest armored fighting vehicles. Radio and compasses are used satisfactorily in tanks. Tracks and motors make less noise. It is reported that successful tests have been made abroad in gas-proofing tanks. (Higher pressure is created inside the tanks and air sucked in through filtering chemical tanks. Used air escapes through the various apertures. Oxygen apparatus has also been tested in tanks.) Visibility from tanks during combat remains one of the major problems to be solved. And if armor-piercing bullets keep improving, something must be done to further improve the armor.

TABLE I

CHARACTERISTICS OF MODERN FOREIGN TANKS

(Read across both pages for all data)

NO.	TYPE	NAME	YEAR	WEIGHT (T.)	ARMOR (IN.)
		BRITISH			
1	Tankette	Carden-Loyd MK. VI	1929	2.0	.24-.35
2	Tankette	Carden-Loyd Patrol	1932	2.2	.31-.44
3	Amphibian	Vickers-Carden-Loyd Amphibian	1931	3.3	.28-.35
4	Light	Vickers-Carden-Loyd 33	1933	3.8	.24-.35
5	Light	Mark II	1932	3.6	.31-.51
6	Light	Vickers-Armstrong 6-Ton A	1930	7.4	.31-.51
7	Light	Vickers-Armstrong 6-Ton B	1931	7.4	.31-.51
8	Medium	Vickers MK. I & IA	1922	11.7	.31-.59
9	Medium	Vickers MK. II & IIA	1927	14.0	.31-.59
10	Medium	Vickers-Armstrong 16-Ton	1929	19.8	.37-1.0
		FRENCH			
1	Convertible Amphibian	Schneider-Laurent Amphibian	.....	11.0	-.59
2	Tankette	Renault U. E. (Carden-Loyd license)	1932 ?	3.1	.16-.28
3	Light	Renault A. M. R.	1931 ?	6.6	-.55
4	Light	Renault M17 & M18	1917	7.4	.24-.87
5	Light	Renault NC 27	1927	8.7	.71-1.3
6	Light	Renault NC 2	.....	8.7	.79-1.2
7	Medium	St Chamond (?)	1930	27.4	.79-1.4
8	Medium	D-1	1932 ?	13.5	.38-1.12
9	Heavy	2C	.....	77	.47-2.0
10	Heavy	3C	.....	81	-2.0
11	Heavy	D	.....	101	-2.0

TABLE I (CONTINUED)

CHARACTERISTICS OF MODERN FOREIGN TANKS

(Read across both pages for all data)

NO.	SPEED (MPH)	CREW	ARMAMENT	L. (FT.)	W. (FT.)	HT. (FT.)	MOTOR HP.
			BRITISH				
1	25-35	2	1-MG, 1-How or 1-Mtr.	8.1	5.6	4.0	22.5
2	30	2	1-MG	8.5	5.7	5.4	40.0
3	6-W 38-T	2	1-MG	13.0	6.8	6.0	50.0
4	30	2	1-MG (0.30 or 0.50)	11.5	6.1	6.5	56.0
5	35	2	1-MG (0.30 or 0.50)	13.0	6.0	5.5	75.0
6	22	3	2-MG	16.0	7.9	6.8	88.0
7	22	3	1-47mm & 1-MG	16.0	7.9	7.1	88.0
8	16	5	1-47mm & 6-MG	17.5	9.0	8.9	90.0
9	16	5	1-47mm & 6-MG	17.4	8.9	8.9	90.0
10	31	6	1-47mm & 3-MG	21.6	8.6	8.2	200
			FRENCH				
1	28-Wh 19-T 10-W	3	1-37mm & 1-MG	19.7	7.2	8.0	100
2	19	2	1-MG	8.8	5.6	3.8	35
3	23	2	1-MG	11.1	5.4	5.1	80
4	5	2	1-37mm or 1-MG	16.2	5.7	7.0	40
5	12-22	2	1-lt. gun & 1-MG	14.5	5.6	7.0	60
6	12	2	1-dual MG	14.5	6.0	7.0	75
7	17	5	1-75mm, 1-37mm, 2-MG				180
8	11-15	3	1-47mm & 2-MG	10.8	6.9	7.0	74
9	9	12	1-155mm, 1-75mm, 4-MG	34.4	11.5	13.1	500 (2)
10	8	13	1-155mm, 1-75mm, 6-MG	39.4	12.9	13.2	1980 (3)
11	11	15	1-155mm, 2-75mm, 1-105mm, 6-MG	45.9	10.5	15.6	2400 (3)

Note: Wh = On wheels. T = On tracks. W = In water.

TABLE I (CONTINUED)

CHARACTERISTICS OF MODERN FOREIGN TANKS

(Read across both pages for all data)

NO.	TYPE	NAME	YEAR	WEIGHT (T.)	ARMOR (IN.)
		RUSSIAN			
1	Tankette	Vickers-Carden-Loyd-Russkij T 27	1927	1.9	.24-.35
2	Amphibian	Vickers-Russkij-Amphibian	1932 ?	3.3	
3	Light	Vickers-Armstrong-6-ton A (Russian built)	1931 ?	7.7	.31-.51
4	Light	Vickers-Armstrong-6-ton B (Russian Built)	1932 ?	8.8	.31-.51
5	Fast Medium Convertible	Christie 32 (Russian built)	1932	11.2	.25-.63
6	Heavy	Heavy MK I		36	.87-1.4
7	Heavy	Heavy MK II		40	-1.0
		POLISH			
1	Tankette	TK 3 (Carden-Loyd)	1932	2.7	.12-.31
2	Light	Vickers-Armstrong-6-ton	1932	7.7	.31-.51
		ITALIAN			
1	Tankette	Fiat-Carden-Loyd	1931 ?	1.9	.24-.35
2	Tankette	Ansaldo-Fiat M 33	1933	3.6	.31-.51
3	Light	Fiat 3000 B	1930	6.2	.24-.63
		JAPANESE			
1	Tankette	Issikawadsima M2592 (Carden-Loyd MKVI)	1932	3.3	.31-.55
2	Light	M2593	1933	7.7	
3	Medium	M89 (fr Vickers MK C)	1929	12.6	.24-.67
4	Medium	M94	1934	15.4	.24-.67
		SWEDISH			
1	Light	Landsverk-100	1934	4.9	-.35
2	Light	Landsverk-60	1934	7.5	.24-.51
3	Medium	Landsverk-10	1931	12.2	.31-.94
4	Medium Convertible	Landsverk-30	1931	12.6	.24-.55

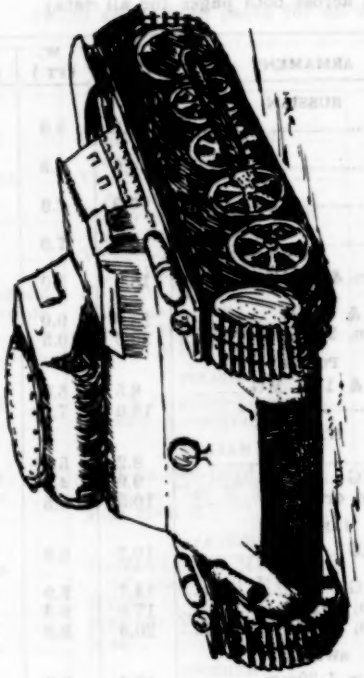
TABLE I (CONTINUED)

CHARACTERISTICS OF MODERN FOREIGN TANKS

(Read across both pages for all data)

NO.	SPEED (MPH)	CREW	ARMAMENT	L. (FT.)	W. (FT.)	HT. (FT.)	MOTOR HP.
			RUSSIAN				
1	25	2	1-MG	8.1	5.6	3.9	22.5
2		2	1-MG	14.0	6.8	6.4	
3	22	3	2-MG	16.0	7.9	6.8	88
4	22	3	2-MG	16.0	7.9	7.1	88
5	68-Wh 38-T	3	1-47mm & 1-MG (Dual)	18.9	7.0	7.6	343
6	28	6	1-gun & 2-MG	23.6	9.0	9.6	250
7	19	12	1-75mm, 2-37mm, 2-MG	30.5	10.5	9.0	350
			POLISH				
1	28	2	1-MG & 1-L. MG	8.5	5.8	4.3	46.5
2	22	3	2-MG	16.0	7.9	7.1	88
			ITALIAN				
1	25	2	1-MG	8.2	5.6	3.3	22.5
2	27	2	1-L. MG	9.9	4.6	3.9	40
3	14	2	1-37mm or 1-MG	10.5	5.5	7.2	63
			JAPANESE				
1	30	2	1-L. MG	10.3	5.8	5.3	45
2	28	3	2-L. MG	14.7	5.9	6.0	85
3	22	5	1-37mm, 2-MG	17.5	8.3	8.5	100
4	28	5	1-37mm, 2-MG	20.8	8.3	8.5	160
			SWEDISH				
1	34	2	1-MG or 1-20mm	13.4	6.2	5.9	130
2	30	3	1-20mm & 1-MG	15.1	6.6	6.1	160
3	22	4	1-Lt. Gun & 2-MG	17.0	7.1	7.3	200
4	47-Wh 22-T	3-4	1-Lt. Gun & 2-MG	17.0	8.0	8.2	200

Note: Wh = On wheels. T = On tracks.



CHAPTER 6

Foreign Thought On The Employment Of Tanks

(AN INFANTRY SCHOOL STUDY OF FOREIGN TACTICS)

In Volume XI of the Mailing List a brief article setting forth Infantry School ideas on the employment of infantry tanks was given. In the present study a broader discussion of tank employment will be made in an endeavor to present the whole subject as it is viewed in several European armies.

FRANCE

In France, mechanization has developed in both cavalry and infantry. Mechanized cavalry is conceived to be the mobile arm, and its missions remain much the same as those given to horse cavalry during its heyday. With respect to the tank, as a subdivision of infantry, the French still cling rather closely to the principles in vogue in 1918. They hold that basically the tank is an accompanying weapon of infantry and must therefore closely cooperate with it. They do not hesitate, however, to use their tanks otherwise when the situation so indicates. In Morocco, for example, French light tanks have been used in a variety of roles, all of which were suitable in that mountainous country to meet the fighting methods of tribesmen whose weapons included almost no artillery. Besides supporting infantry directly in action and disengagement, light tanks were used as patrols with advance

and flank guards, and as stationary blockhouses or pill-boxes, as outposts, and even for supplying isolated posts. One even became the toy of a Moorish harem lady, it is said, who considered it less monotonous than a camel.

In a possible European war, however, French tank employment is far more orthodox. On a division front a battalion of light tanks* is considered necessary, with two or more battalions in the zone of the main attack. When allotted by attachment to infantry battalions, a tank company is deemed proper for adequate support. Occasionally, tank platoons are attached to rifle companies.

Medium tank companies,** of which the French have very few, are to be held for use against excessively shell-torn terrain and heavily intrenched positions, especially where wide trenches are found.

Heavy tanks*** are reserved even more for particular situations, as against very strong positions.

During the past year or two a gradual inclination toward the British view has been apparent in French thought on armored fighting vehicles. This has been particularly noticeable in army maneuvers, where their mechanized cavalry has been used on missions like those visualized for the new British mechanized cavalry division.

The French have a newly reorganized cavalry division that is entirely motorized and mechanized, which uses combat cars (track-laying tanks), half- or semi-track armored cars, four- and six-wheelers, motorcycles, and tractors. This division is believed to be constituted along the following lines:

1 Exploration Regiment (2 M. G. motorcycle troops and 2 armored car troops).

1 Armored Car Brigade (2 regiments, each of 2 M. G. motorcycle troops, 2 combat car (tank) troops, 1 exploration car troop and 1 reconnaissance car troop).

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*Three companies, each of three platoons of five tanks.
**Three platoons each of three tanks.
***Three in each company.

1 Dragon Porte Brigade (2 regiments, each of 2 battalions carried in cross-country vehicles).
1 Regiment 75-mm guns (tractor drawn).
1 Regiment 105-mm guns (tractor drawn).
1 Battalion Engineers and Bridge Train (motorized).
1 Air Squadron.

Forces of this type are considered suitable for covering the gaps in the fortified French frontier or for meeting penetrations through this fortified line.

GREAT BRITAIN

Although bitterly opposed in many quarters, a reorganization and amplification of Britain's mechanized elements was ordered in December, 1935, by the War office. The reorganization in the cavalry and Royal Tank Corps involves—

(a) The conversion of the existing cavalry division and the Tank Brigade into a mechanized mobile division of two mechanized cavalry brigades—each consisting of two motor cavalry regiments (carried riflemen), and one cavalry light tank regiment (four light tank companies), and the existing Tank Brigade (four battalions), together with necessary divisional troops.

(b) The conversion of the cavalry brigade in Egypt into a mechanized formation consisting of one armored car regiment, one motor cavalry regiment (carried riflemen), and one cavalry light tank regiment (four light tank companies).

This puts eight cavalry regiments on wheels and tracks and leaves thirteen regiments horsed.

The Tank Brigade remains unchanged except that it is swallowed by the new cavalry division. The components of the Tank Brigade are three mixed, or medium, tank battalions and one light tank battalion. The medium battalions each have three mixed companies. Each mixed company has one platoon of five medium tanks, one pla-

toon of seven light tanks, and two close support tanks. A light tank battalion has three companies, each of three platoons of five light tanks, and two close support tanks. There are 49 tanks in the mixed battalion and 60 in the light battalion.

The methods of operation generally considered as proper for the Tank Brigade fighting as a separate force are as given immediately below.

The main duty of the light tank battalion is to reconnoiter well ahead of the mixed battalions and to protect them while they deploy and prepare to launch the attack; then to protect the flanks during the attack; and thereafter to cover the assembly and reorganization for the next movement.

While protected by the light battalion, the mixed battalions are given their objectives, and the companies in turn their tasks. Within the company the platoon of light tanks hunts for the enemy and informs the medium platoon of his location. The light tanks then engage the enemy with machine-gun fire generally from stationary, defiladed positions, which they can usually find thanks to their small size. Under this protection, the medium platoon maneuvers to strike the enemy most advantageously and delivers its attack, over-running and crushing the enemy positions—materiel and personnel.

The work of both light and medium tanks is assisted by the two close-support tanks of the company, which help mainly by firing smoke shells to blind hostile antitank-gun positions.

It is probable that the incorporation of the Tank Brigade into the Mechanized Cavalry Division will not greatly alter its general scheme of operations. It will have two additional light battalions for distant reconnaissance to front and flanks, for advance-, flank-, and rear-guard employment, and for delaying actions and raids; and will have the four motor cavalry regiments to occupy and consolidate the positions captured by the action of the tank battalions. Among the divisional troops listed as a part of the mechanized division there will doubtless be tractor-

or motor-drawn or self-propelled artillery to support the operations of the mechanized, as well as the motorized, elements of the division.

The conversion of the cavalry brigade in Egypt into a force consisting of one armored-car regiment, one motor cavalry regiment (carried riflemen), and one cavalry light tank regiment (probably four companies) creates a type of brigade different from those of the mechanized division in England. An armored-car regiment (probably four or six troops) is substituted for one of the two motor cavalry regiments contained in the brigades of the mechanized division. For police work and frontier defense against native tribesmen, this is unquestionably a good idea because numerous small patrols must frequently be sent to dangerous areas, and these detachments need protection from small-arms fire and require rapid transport, both of which are given by armored cars.

From the foregoing the reader may be led to believe that the British do not contemplate using tanks in close accompanying support of infantry. There are, it is true, a few tank zealots who hold this belief, but they are in the minority. It is generally admitted that many occasions will arise in a future war where the Tank Brigade, the new mechanized division, or any similar force cannot handle the job; where only infantry, supported by artillery and tanks, is capable of succeeding. In such circumstances, it is expected that at least one tank battalion will be required for each division zone. Tanks so used are classed as *army* tanks or "I" tanks (i.e., *infantry* tanks).

It is believed that light and medium tanks of the pattern developed during the past ten years are unsuitable as "I" tanks primarily because of their thin armor which is inadequate to face antitank guns. As a result, a slower and more heavily armored vehicle is intended to be used in army tank battalions. Besides these vehicles available to the division and higher echelons, the infantry brigade (four battalions) is to have its own immediate support within its machine-gun battalion. This will be given by the armored machine-gun carriers. To show what was

contemplated and is now being carried into effect in the British Army, the following quotation is given from the lecture of Colonel G. N. Macready, C.M.G., D.S.O., O.B.E., M.C., before the Royal United Service Institute, November 14, 1934, "The Trend of Crganization in the Army."

The Infantry tank.—***It has been decided that army tank battalions are to be provided on the scale of one battalion per infantry division. The tank in these units would be of a different pattern to those in the tank brigade. Its role would be: to clear a passage through wire; to deal with unneutralized machine guns; and to keep up the momentum of the infantry attack.

The primary requirements of such armored fighting vehicles are armor and inconspicuousness. Speed and radius of action will have to be sacrificed to some extent in order to obtain the necessary thickness of armor; while the armament will probably consist of machine guns and antitank weapons. The tank itself is still in an experimental stage, but we hope that before very long it will be possible to go to production.

The armored machine-gun carrier.—Another difficulty which we are trying to overcome is that of bringing the Vickers machine gun rapidly into action in support of infantry for such purposes as consolidation of the ground or covering rear-guard actions; accordingly it is proposed next year to continue experimenting with armored machine-gun carriers. The object of these armored carriers is to enable machine guns to advance rapidly over fire-swept zones and to come into action, if necessary, from the vehicle though not on the move, as the latter would practically necessitate the provision of a tank. The machine gun will, of course, be capable of being taken out of the vehicle and fired from the ground when required. These armored carriers, if found to be successful, would be incorporated in the companies of the machine-gun battalion.

This inconspicuous "creeper", with one man and a gun, should be capable of getting forward at five or six miles an hour to a point close enough to compete (from partial defilade) with the hostile automatic weapons. As an "infiltrator" or "infighter" Colonel Kershaw* contends it "will meet a large number of the difficulties of infantry

*Fighting Forces, April, 1935, *Help for Infantry in Attack.*

and confer the following advantages upon that arm:

(i) Provide armored protection for leading troops over the last 600 yards.

(ii) Provide machine-gun covering fire, keeping pace with the leading troops.

(iii) Solve the problem of getting forward machine guns *and their ammunition.*

(iv) Enable the leading infantry to cope with hostile machine guns on equal terms.

(v) . . . penetrate wire by cutting through or passing under it.

(vi) Familiarize a proportion of infantry with the handling and tactics of their type of armored vehicle. This vehicle . . . does not advertise its presence by its size, as did the Carden Loyd.

This author advocates the use of a "creeper" to carry each of the three light machine guns of the rifle platoons. Lieutenant Colonel G. Le Q. Martel in his *In the Wake of the Tank* makes a similar suggestion. It seems most likely, however, that this "scooter" will be used by the companies of the machine-gun battalion in the infantry brigade, which, incidentally, is similar to our new infantry regiment except for having its mortars in the rifle battalions instead of the "4th" battalion, as we do.

Major C. G. D. Thrupp, Royal Tank Corps, writing in the Journal of the Royal Artillery, Jan., 1936, states that the "I" tanks will be organized into army tank battalions. He says that "the role of this tank is intended to be the intimate support of the infantry in the attack; and as in 1916-18 this role will doubtless comprise the crushing of the hostile wire and the neutralizing of the enemy's machine guns, and maintaining the momentum of the attack. In defense it would closely cooperate with the infantry in counterattacks."

In all fairness to the advocates of fast, maneuverable, A.F.V.'s, as the British term their armored fighting vehicles, we must see what Major General Fuller, high priest of the believers in the supreme destiny of tanks, says. The following is the gist of an article in the Army, Navy, and Air Force Gazette of 26 September, 1935:

The speed of tanks should be used against the flanks and

rear of the enemy. Infantry tactics require an assault; tank tactics require maneuver. Infantry attacks have perforce become a thing of the past, and it is useless to try to revive them by means of a machine that only gives a minimum return when used in this kind of operations. Modern infantry can no longer be used except to occupy ground. It will still have an important place in a future war but certainly never the same as it occupied in 1918. For protection it needs a light and fast armored vehicle, which should not attack fortifications but protect the rifleman against motorized and mechanized incursions of the enemy. This vehicle should be an antitank tank, not a machine-gun tank.

British tank thought can then be summarized in so far as functions of different vehicles are concerned—

Light tanks, to reconnoiter in cooperation with armored cars, airplanes, and cavalry; and also to cooperate closely with medium tanks when the light tanks act as eyes for them.

Medium tanks, to destroy the enemy by fire and shock action.

Heavy tanks, for stabilized warfare only.

Close support tanks, to accompany medium and light tanks in order to give them heavy covering fire or smoke screens, and to deal with unexpected targets which normal supporting artillery is unable to see.

Armored cars, for long distance reconnaissance, and also protection of convoys and internal security.

"I" tanks, one battalion per infantry division, to give close accompanying support for infantry, of which they are actually a part.

Machine-gun carriers, to provide means for bringing machine guns of machine-gun battalions, rapidly into action in support of infantry for such purposes as consolidation of the ground or covering rear-guard actions.

British policy with respect to the tactical employment

of tanks can be seen in their different types of armored fighting vehicles and the functions of each. It is apparent that they visualize many different missions for mechanized vehicles and realize that a special machine is needed for each. Thus the tank brigade, composed of fast, light, medium, and support tanks, is expected to operate independently or in conjunction with motorized (carried) riflemen and motorized or mechanized artillery against rear installations, reserves, and forces on the march. Again, it might deny terrain to the enemy as by delaying action. Or it might even attack in conjunction with foot troops—probably by making an envelopment or a turning movement. Baby tanks—the inconspicuous creepers worming machine guns forward—merely take the place of carts and mule or man power in moving infantry weapons forward, and give the gunner a modicum of protection. "I" tanks, organized into army tank battalions, fill the role played by the Whippets and Mark V's in 1917 and 1918; i.e., close support to infantry.

U. S. S. R.

The Red Army follows somewhat different principles for tank employment, which partly straddle the French and British doctrines, inclining more toward the latter, but in reality going beyond both of them in many respects. In the preceding chapter, we saw that the 3,500-10,000 Soviet tanks are mostly of light tank and tankette design, with about 600 tanks of Christie suspension. This, in itself, indicates that their tank principles are not those of the last war.

On stabilized fronts such as those of 1918, and also in mobile situations, tanks will be used so as to give the attacking infantry protection against the combined fires of the defense by the simultaneous destruction or neutralization (by tank action) of all the agencies of fire of the hostile defense—artillery included. In brief, Russian

tanks are to be more than mere mobile, armored machine guns and infantry cannon striking the immediate front lines of the enemy; they are to take over much of the work formerly performed by artillery.

To do this, three groups come into action in the attack. These are the *distant action* group; *direct support* group, and *close accompanying* group. Let us see what sort of tanks are used in each group and how they are used.

THE DISTANT ACTION TANK GROUP

The objectives of this group are the artillery, the regimental and divisional reserves, staffs and rear area establishments.

The tanks composing this group will always be the fastest that the commander of the attack has at his disposition. In general they will be medium, fast tanks carrying a small cannon and several machine guns.

The group of distant action tanks is organized by the corps commander or division commander, if the latter controls the distant action artillery.

The quantity of tanks entering into its composition is calculated on the basis of one platoon of five tanks per objective to be attacked. It is admitted, however, that the group will never contain less than two companies; its composition generally being one battalion.

The distant action group, operating for the benefit of the attacking infantry, must attack the enemy artillery at the moment it is most dangerous, that is, when the infantry reaches the outer fringe of the line of resistance to be taken. Hence, it must be able to neutralize this artillery when the infantry leaves its line of departure.

The hour of its departure is determined, therefore, with this object in view. The tanks of the distant action group debouch behind or simultaneously with the *direct support* tanks, which are charged with the neutralization of the antitank weapons of the hostile position of resistance. They advance directly on their objectives, which they en-

deavor to reach with the least delay, only engaging those antitank guns that impede their progress.

The batteries to be neutralized are approached from the rear in order to catch the personnel exposed, or from the flank in order not to give a single piece the chance of engaging the attacking tank. It is considered that the neutralization of the batteries can be accomplished in 10 or 15 minutes.

The Soviet regulations prescribe that after carrying out their incursion the tanks should remain in the zone attained until the arrival of their own infantry. Many of their officers contend, however, that this obligation imposes on the tanks an extremely dangerous halt of from two to three hours within the enemy lines, and prefer an assembly in the zone behind the position of resistance where they should ordinarily find their own infantry, and then operate for its advantage as the situation demands.

During the debouch and advance of the distant action group, the artillery of the attack engages the hostile batteries until the approach of the tanks, or with its fire covers the flanks. On occasion it can facilitate the withdrawal of the tanks in case their action is unsuccessful.

Aviation can assist when possible by establishing a smoke screen on each flank of the advancing tanks, or by attacking the hostile batteries and thus pointing them out to the tanks and facilitating their approach.

The distant action group is equipped with radio to include the platoon leader's tank. It communicates normally with the artillery and aviation.

THE GROUP OF DIRECT SUPPORT TANKS

The mission of direct support tanks is to destroy or neutralize the means of fire distributed in the zone in rear of the position of resistance: machine guns, accompanying weapon batteries, single cannons, battalion and regimental reserves. This leads to the possibility of penetrating up to one mile into the enemy lines.

The materiel constituting the direct support group will be light tanks, probably of less speed than those of the other two groups. The allotment contemplated is, in general, one company to each attacking regiment.

The group of direct support tanks is either controlled by the division commander, or reallotted to the attacking regiments. Various factors enter into determining who should be in control—

(1) On a narrow front, to insure better coordination with the other arms, the group will be constituted within the division echelon. On a wider front it will be preferable to let regimental commanders organize their group of direct support tanks.

(2) On open terrain, with wide visibility, centralization under the division is required, whereas, in broken country, with terrain compartments, decentralization to regiments is preferable.

(3) If the division attacks in a single terrain compartment, it should be responsible for organizing a single direct support group under division control. If, on the contrary, each regiment attacks in separate compartments, the duty of controlling the different groups should fall to the regimental commanders.

The number of tanks available for the attack will not always permit the organization of a direct support group. In this case, the group will be sacrificed to the use of the *close accompanying* group, which will then be given a mission deeper than that which normally falls to it.

THE GROUP OF CLOSE ACCOMPANYING TANKS

This group is destined for close and constant collaboration with the infantry. The group's primary mission is to accompany infantry everywhere by intervening in the zone of its action and likewise in the zones where the attack does not penetrate, but from which may come fire capable of arresting the advance of the infantry.

The close accompanying group will be constituted by the

use of the lightest tanks that the commander of the attack has at his disposal. The allotment varies from one platoon to one company per attacking infantry battalion. The allotment of one platoon is not generally made except for attacks directed against objectives of secondary importance.

The action of close accompanying tanks should above all exert itself when the infantry arrives at assault distance. The tanks should therefore reach the forward hostile positions when the infantry is still about 200 yards from them.

Set in motion by the infantry battalion commander, the close accompanying tanks are entirely utilized to engage the means of fire of the position of resistance throughout the zone of action of the battalion, making their effort principally against the point of the hostile defense which, if broken up, will dislocate the defense and facilitate the infantry mission.

Close accompanying tanks advance directly on their objectives without "tacking" or maneuvering, and constantly keep visible contact with the infantry. They do not outdistance it more than 1,000 yards in order to be always within the protection of its arms, and in order to be able, if the need arises, to rapidly turn back to neutralize or destroy the weapons that may stop the infantry advance.

Tanks engage antitank guns when they are encountered. As soon as one exposes itself, it is instantly taken under fire by the tank that discovered it, which fires a tracer shell in its direction.

This is a signal for the near-by tanks, which automatically concentrate their fires on it.

The action of tanks against nests of resistance with automatic arms well sited in narrow, deep, and carefully camouflaged trenches will often be difficult owing either to the difficulties of observation or to the impossibility of reaching the defenders by fire. Cleaning out these nests of resistance can be facilitated by the intervention of tanks

provided with flame-throwers. (This does not look practical owing to the short range of flame throwers—less than 30 yards.)

EMPLOYMENT OF ARTILLERY

The missions provided for artillery are the following:

(1) Before the debouch of the attack:

(a) Destruction or neutralization of the fires of the antitank defense;

(b) Counterbattery.

(2) During the attack:

(a) Fire on dangerous or suspected dangerous points that are inaccessible to the tanks;

(b) Direct support fire and protective fire on the fronts of the zone of attack where tanks are not to be employed;

(c) Fire on the most visible objectives (primarily antitank guns) situated in the zone comprised between groups of direct support and close accompanying tanks, whenever good observation is possible.

It is obvious that this scheme imposes an artillery problem that is difficult to solve. Actually, in most cases, an offensive action supported by a deep penetration of tanks cannot count on more than intermittent and fragmentary support of the artillery after the tanks penetrate into the enemy position.

Is the tank sufficiently powerful and is its invulnerability sufficiently great for it to take over and carry out with a minimum probability of success all the missions that formerly devolved upon the artillery? It is premature to answer that question.

The Red Army tactics for tankette units, of which it has many, is much the same as ordinary cavalry tactics. Tankettes are considered to be eminently suitable for reconnaissance. They are capable of supporting advance

guard actions and even of striking an enemy in position if he is not strongly organized for defense. Their speed makes them ideal for pursuit. In defensive action they become the hammer head of shock groups used to strike counterattacking blows—corner-stone of Red Army defensive measures. Either by assisting the rear guard or by acting independently, tankettes are also employed to cover withdrawals from action.

Soviet officers hold that the characteristics of the tankette—inconspicuous size, maneuverability, speed of 25 mph, firepower of one machine gun, and armor protection—admirably fit it for the foregoing uses.

As a means of combat reconnaissance tankettes are used to reconnoiter the battlefield with the mission of keeping the unit commander constantly informed on changes in the situation.

As a means of tactical reconnaissance tankettes operate in *separate patrols, separate groups,* and *reconnaissance detachments.*

A separate patrol is usually a platoon of five vehicles, accompanied occasionally by light armored cars. A group usually has two or three platoons and goes out farther than a patrol—as far as 10 or 12 miles with security vehicles a mile or so in front of it. A detachment contains at least a company of tankettes, oftentimes more, which are attached to other arms. Its action may take it 20 miles in advance of the main force. While they are in the zone of imminent contact, reconnaissance units move by bounds from cover to cover.

A tankette patrol, group, or detachment sent on reconnaissance usually knows the approximate location of the enemy from aviation reports. The commander can therefore determine roughly how far he dares advance before deploying. Security or scout tankettes are, of course, sent out to the front and flanks of the reconnoitering unit for its own protection and information. In addition, a unit the size of a reconnaissance detachment gets regular reports from observation aviation. Such a detachment must

retain the bulk of its vehicles in hand ready to strike a rapid blow when the enemy is encountered.

Tankettes may be used as *close accompanying tanks* when the enemy is not strongly organized for defense. Otherwise it is considered most expedient for them to be used to strike short, concentrated blows against the hostile flank. When so used they must be given necessary artillery and chemical support.

Tankettes are also largely used with *distant action* groups for reconnaissance in force and tactical reconnaissance, and to accompany horse cavalry.

When a meeting engagement with the enemy is imminent, tankettes are sent out ahead of the regular advance guard to strike the hostile advance guard, break through it, and hit the hostile columns. Surprise and rapid action are always sought, so the commander of the tankette force usually selects a covered route and then moves personally with his advanced vehicles in order to see the situation first hand, make a quick decision, and strike before the enemy can dispose his antitank defense or deploy and thus minimize the effect of the tankette blow. Like deft cavalry blows, tankette attacks do not try to crush but merely to create as much damage and disorganization as possible before the enemy can dispose his elements for defense. Then they withdraw to reform under cover and hit elsewhere in like manner.

Tankettes are also used with a force sent out to cover the mobilization, advance, or deployment of a larger force. On such an operation, the tankettes are given delaying missions similar to the harassing action formerly assigned to cavalry patrols. The tankette unit may act as the advance guard of the whole delaying force and, with a few vehicles on outpost patrolling a mile or so in advance, merely occupy a suitable concealed position from which it can deliver short attacks to disorganize the enemy.

In pursuit it is most common for tankettes to move parallel to the retreating enemy initially in order to utilize roads or more favorable terrain until critical areas in the

line of retreat are reached in which the enemy can be attacked most effectively. At times it may be necessary to divide and hit at several places on his flank instead of making concentrated blows.

Tankettes that are a part of a force occupying a defensive position are used for reconnaissance before the enemy arrives or before he closes to striking distance. Thereafter they are used to harass him and disorganize his concentrations for an attack, and finally when he attacks, they are thrown against him when he leaves his assaulting position. Later, after he has lost the impetus of his attack, and is disorganized, they counterattack independently or as the mechanized element of powerful shock groups.

During a withdrawal from action tankettes operate either with the rear guard or independently. As a part of the rear guard their action is similar to that of any other supporting mission—they support by offensive action. When acting independently they organize a mobile defense on successive positions, from each of which, in turn, they launch short attacks on the enemy. In covering the withdrawal of infantry they should endeavor to strike simultaneously along the entire line in order to fully cover the retrograde movement.

From the foregoing, it can be seen that tankette tactics in the Red Army, although seeming to be based on an exaggerated conception of what tankettes are capable of doing, enter largely into their whole military doctrine. Moreover, from the brief description of the methods used by the distant action, direct support, and close accompanying tanks, it is apparent that the subject of mechanized warfare has been thoroughly studied in the U.S.S.R. and is in the front rank of its training and preparation for war.

POLAND

We shall dismiss Polish employment of tanks by saying that the Polish Army follows closely all new developments,

all training regulations, and all military discussions in Soviet Russia. Polish tanks are mainly light and ultra-light types. And more than likely their principles of employment parallel those of their eastern neighbor, with, perhaps, some seasoning from the methods of the neighbor to the west. If Soviet ideas on tanks are audacious, as they are considered by many to be, then Polish ones must be likewise.

GERMANY

Not a great deal more can be said of German tank thought than of Polish. This much is known, however; all German military periodicals constantly feature pictures of the latest British tanks in typical fighting attitude, discuss the latest developments technically and tactically in the Royal Tank Corps, and closely follow all mechanized maneuvers on Salisbury plain. It would seem that the Germans take their leads from across the Channel. Yet there is no fixation for British ideas; close behind comments on what the British are doing come the developments in France, Italy, Japan, Russia, Poland, and the United States. This the Germans have been doing ever since the War. When they had no tanks they used dummy tanks for training purposes—tank and antitank. During those years they watched the painful "trial and error" developments in other lands. They learned by the stumbling, the blunders, and the costly experimentation of others. They learned cheaply. Moreover they watched the whole panorama, not merely one narrow scene. There were no petty difficulties to befog their vision of the essential factor to keep in the foreground; namely, to develop logical, modern methods for using this new weapon and then to build machines suited to these methods.

When the Germans had no tanks, they built up a powerful motorcycle machine-gun corps. These units must now be rated along with armored cars and tanks in their attributes of mobility and firepower, although they do not

give crew protection and have practically no shock action. But these *Kradschutzen* companies are undoubtedly a part of all mechanized forces and even of non-mechanized units in Germany today.

Germany is motor minded and mechanically minded. Her army is said to be undergoing a complete conversion to motorized and mechanized units. German officers believe in mass employment of armored fighting vehicles. That being true, we can expect to find motor-mechanized divisions in the German Army that are similar to the British mechanized cavalry division (described earlier), or organized along the lines of a division that was widely commented upon over a year ago in the French and German technical press. The main components of this division are—

Division Headquarters: Staff, platoon light tanks, platoon light armored cars, platoon motorcyclists, flight of 12 airplanes.

Reconnaissance battalion (light armored cars).

Signal battalion (motorized).

Tank brigade: light tanks, medium tanks.

Motorized infantry brigade: transported rifle battalions with machine-gun battalions using motorcycle-side-car and cross-country-car transport.

Artillery regiment (towed and self-propelled).

Antitank and antiaircraft artillery group (motorized or self-propelled).

Engineer battalion (motorized).

The tactics of such a division would be much the same as in the British mechanized Cavalry Division. That is, the armored cars and motorcycles, with the aid of aviation, would reconnoiter for the enemy, endeavor to fix him, and then assist the tanks and infantry in their attack. The tanks neutralize enemy fire and destroy his barbed wire, machine guns, and positions, while the infantry (brought as far forward as possible on their motor carriers) occupy and hold the ground gained.

The German Army is noted for its ability to achieve

surprise and rapid movement. As these are the essence of success in tank operations, it is certain that every precaution is taken to make these two items paramount in German tank doctrine.

JAPAN

The Japanese have met, in their small wars and occasional big battles on the mainland, a mobile type of fighting, and they have usually been opposed by an inferior enemy. In such warfare tank operations become raiding and harassing actions, and soon acquire the British cut. Thus far the Japanese Army has exhibited very little ability in the use of mechanized weapons. At Shanghai the terrain was unfavorable—a network of canals and ditches—and the tanks did nothing. In Manchuria and the provinces to the southwest, tanks contributed more to the rapid advances made by the Japanese. Not only did the type of operations influence Japanese methods of using tanks toward the British styles, but the fact that most of the tanks bought abroad were English built must also have been an influence, for it is only logical to assume that a few tactical principles travelled with the tanks to the Far East.

ITALY

Italian tanks have been on trial, and so too have her methods of using them—methods that in Ethiopia had to be suited to fighting native tribesmen in country far from ideal for tanks, but otherwise ideal in that few antitank guns were encountered. In the Eritrean Army, tanks did little on account of the extreme ruggedness of the area traversed. In the Somalia Army, which has been advancing over relatively flat desert country, General Graziani has made great use of both tanks and armored cars. Last fall (1935) they served as advance combat

patrols and seized desert wells from the natives attempting to hold them. At the same time they performed valuable reconnaissance, and no doubt terrified many natives into submission.

It is probable that the three fast divisions of the Somalia Army were organized like a division which was tested in the autumn of 1934. This consisted of two wings, the one horsed, the other mechanized. In the former were grouped cavalry, horse artillery, and cyclists; in the latter were tanks, motorcyclists, motorized infantry, and motorized artillery. In addition there were the usual signal, pioneer, and supply units.

Italian tank tactics are mostly built around her 3-ton Ansaldo-Fiat two-man tanks, which are armed with one machine gun and can travel over 25 mph. In Ethiopia, they lead the way wherever the terrain permits. They have been used like cavalry to conduct raids. Together with aircraft they have exploited successes and pursued the retreating natives. They have also aided foot troops by driving the enemy from key positions and holding them until occupied by friendly troops. It is probable that security missions to the front and flanks have also been common assignments of the tanks in Ethiopia.

So much for colonial warfare. In a major war in Europe, Italy would probably combine her baby tanks with battalions of heavier vehicles, as the British do, and use these mixed units for thrusts at the enemy flanks and rear. Such tactics would at least be likely if her shores were invaded. On the northern frontier this might also work unless the situation became stabilized, when a reversal to French methods might be the only solution.

We have now viewed many different tanks and have seen how they are used in various foreign armies. Detailed technical descriptions and long dissertations on tactics have been avoided. The whole aim of this study on foreign tanks and the way they function has been to present an up-to-date picture of what has been done

abroad in mechanization, how far it has progressed, and how it is considered in the military minds of Europe. Developments of the past decade and especially the past half-decade have been stressed, for in these years the progress has been most rapid and most valuable.

One fact must have been noticeable: namely, the importance of light or rather ultra-light tanks—tankettes—in foreign armies. Every country has them, and in England, Russia, Italy, and Japan they appear to be a popular type of armored fighting vehicle. What is the significance of this fact? Does it indicate that they are demonstrating greater possibilities in mechanized war than other designs? England counts on them to reconnoiter, delay, and divert while the heavier machines are maneuvering for a crushing blow. Russia does the same but goes much far-their and has them operate in many situations as separate units. Japan prefers them for Manchurian service. Italy uses them almost entirely in Ethiopia. Perhaps tankettes can do what their supporters predict, but they have yet to undergo the test of a first class war, and even the Ethiopian tribesmen have learned to attack them from their blind sides (the one machine gun carried can only be fired to the front).

It must be admitted that tankettes have many theoretical advantages. They are small enough and fast enough to move rapidly from cover to cover and actually conceal themselves, or at least present a very small target, while they fire from a stationary position—the habitual procedure because of the more effective fire obtainable. They are good liaison agents. They are inexpensive by comparison with larger vehicles, and can be supplied in greater numbers at less cost. Tankettes are, actually, the light, mobile scouts and combat patrols needed by a mechanized force or any other force fighting in this machine age.

As for the possibilities of the British "I" tank, let us look at what Major J. K. Edwards, M. C., Scots Guards,

says in the Journal of the Royal United Service Institution for February, 1935.

* * * * * * * * *

* * * It must be admitted that modern light and medium tanks have developed far beyond the stage of close cooperation with infantry attacks. To restrict existing and future tanks to this role is to sacrifice their most potent battle qualities, while the temptation to fritter them away in piecemeal attacks may prove irresistible owing to the desire to save infantry casualties. On the other hand, we must be equally reasonable and admit that there is no shred of evidence to suggest that in war, in our time at least, infantry will not be required to attack and capture defended positions as the principal means of obtaining tactical success. It is equally evident that to launch infantry against this type of opposition with insufficient support will result in heavy loss in men and morale * * *

* * * It follows that, without an enormous and uneconomical increase in artillery, some form of tank support must be regarded as the normal rather than exceptional accompaniment of infantry attacks against organized positions * * *

The requirements of an infantry support tank are low cost of production, fair cross-country mobility, and a good machine-gun platform with a small crew. Endurance must remain a secondary consideration.

In attack the role of these vehicles is that of providing the maximum support for infantry, by seeking out and destroying hostile machine guns, and crushing wire. In defense, they will form a mobile reserve of fire power, and will be available to support counterattacks. The provision of an infantry tank battalion within the division will release existing medium and light tanks for what now must be accepted as their proper role. This is clearly cooperation with other mobile troops or inclusion in armoured formations; or "break-through" tasks when the crust of the enemy position has been penetrated, exploitation beyond the enemy's lines, and pursuit.

* * * * * * * * *

* * * Inadequate provision of "I" tanks in war will result in misuse of tank formations by commanders who will have no alternative if infantry casualties are to be saved.

THE FUTURE

What of the future? Will the tanks of today and the tank tactics of today be worth any more a decade or two from now than World War machines and their methods are worth today? Will all world armies be completely mechanized? Will the foot soldier still be necessary? Will all ground forces be entirely supplanted by air forces? These and other questions are constantly asked and vaguely answered in the press. Positive assertions in military periodicals cannot be given much more credence than the wild conjectures of the press. Time alone can answer all these questions.

Of this we can be certain, however, military methods must keep pace with the scientific progress of the world. There can be no turning back to "the good old days when bayonets flashed in the air as line after line wheeled to charge, while on the flanks the cavalryman drove their chargers across the dusty battlefield". Those days are gone forever. We are in a machine age and an age of tremendous scientific developments. Tanks and motors are just as much a part of this era as are the radio, the telephone, and the airplane. We must accept the fact that machines have invaded the art of waging war and have changed its tempo. They are not going to be everything but they are bound to have their place in the picture. What that place is, what kind of machines we want to fill it, and then how these new implements are to be fitted into their proper place—those are the problems still only partly solved. Warfare even of the immediate future is going to be far different from what it is today or was eighteen years ago. And in any future war armored fighting vehicles will be given an important role to perform, a role that will become more and more prominent in proportion to the increase in quantities and quality of machines produced by the mobilization of industry.

CHAPTER 7

The Caliber 0.22 Machine Gun

(New Infantry School Teachings On This Weapon)

This chapter on the caliber 0.22 machine gun is written for those who desire to make the most of the training capabilities of the gun, and, moreover, to correct any impression that the gun is solely an adjunct to target practice. For instance, the fact that it can be used to teach indirect laying is not generally appreciated; yet indirect laying is of great importance since the tactics of the new infantry organization, with all heavy machine guns in the 4th Battalion, call for much long-range machine-gun fire, which in many cases, if not most, will have to be delivered by indirect laying methods. However, limitation of range facilities in a great many places makes this training difficult with caliber 0.30 guns. National Guard units, particularly, which have to train indoors most of the year, find this problem hard, or even impossible to solve with service ammunition. But, the caliber 0.22 gun can be fired indoors, using cheap ammunition and a miniature range or landscape targets; and actually a unit can be trained in indirect laying in some respects better than on a full-sized range with caliber 0.30 ammunition. For one thing the whole process is brought down to where the individual soldier can actually see what the results of his fire are and how the different elements of the company combine to place fire on a selected target. Errors are quickly seen and easily checked, and a careless individual by his own actions points himself out. In such teamwork as machine gunnery, this is a highly important part of

training, for no man likes to know that his carelessness or stupidity frustrates the effort of the group, and that the group moreover knows it, too.

This chapter, therefore, is primarily of interest to machine-gun officers. But any officer with machine-gun units under his command can read it with profit. Section I takes up the employment of the gun and how it may be used in indirect laying; Section II deals with the functioning and care of the gun and with safety precautions that should be observed. Section III contains miscellaneous data about the gun including how to obtain zero quadrant elevation for indirect laying and a new and tried method of mounting the machine gun on a sandbag instead of a T-base. This method was developed for the 0.30 caliber gun. It has proved its value in target practice and is well adapted for either caliber 0.22 direct or indirect laying.

SECTION I

EMPLOYMENT

The caliber 0.22 machine gun is of particular value during instruction in the technique of marksmanship, direct and indirect laying, and to a limited extent, in combat practice. The gun should also prove to be of training value during short-range instruction in antiaircraft marksmanship when the technique for this phase of training is more definitely prescribed. In all its uses, however, certain differences between the caliber 0.22 and caliber 0.30 machine gun require consideration. The more important of these differences are outlined below.

MARKSMANSHIP

Marksmanship training should be conducted at 500 inches rather than at 1,000 inches, owing to the difficulty of observing the smaller bullet holes. Special tar-

gets are available for issue for the 500-inch firing. These are merely 1,000-inch E-targets reduced to one-half size.

Ammunition belts now issued with the caliber 0.22 gun have a capacity of 100 rounds. The present marksmanship course designed for training with the caliber 0.30 gun requires firing a record practice of 150 rounds within a time limit of three minutes. To fire this course using the 100-round belt the three-minute allowance must be divided into two parts. The first part is the time the gunner actually takes to fire the first 100-round belt; the second, the time then remaining of the three minutes originally allotted. A second belt, containing the 50 rounds necessary to complete the course, is loaded in the gun, without penalizing the gunner for his reloading and relaying time.

In this regard, a new marksmanship course is at present under consideration for use with the caliber 0.30 gun. Among other changes, the record practice is divided into a series of exercises each of which is fired with separate time and ammunition allowances. Since none of these exercises uses more than 100 rounds of ammunition, this course will automatically eliminate this difficulty.

Another matter that must be allowed for is a difference in sight-leaf graduation. The sight leaf on the present caliber 0.22 machine gun is that of the Browning machine gun, M1917, designed for use with M1906 ammunition. It is possible that this leaf will be replaced with the one now being issued for the caliber 0.30 machine gun when M1 ammunition is used. (M1 ammunition has now replaced M1906 almost entirely for issue.) Whichever sight is used, however, the graduations have no real significance in firing caliber 0.22 and are of value only for reference.

At the longer ranges it is necessary to use equivalent sight settings which give the barrel the elevation required to compensate for the difference in trajectories of the caliber 0.22 and caliber 0.30 bullets. A conversion table for this purpose has been used successfully and found approximately correct. (See Table II.)

At 500 inches the gun should first be carefully targeted,

as described in paragraph 83, Basic Field Manual, Volume III, Part Three. The normal zero of a gun at 500 inches corresponds to a sight setting of 800 yards. Sight settings required to hit the various spaces on the E-target should then be determined by the test firing of a skilled gunner. These settings should prove to be approximately 1,000 yards for the traverse, 1425 for the application, 1175 for the search, and 900 for the oblique, scoring spaces. In cases where individual gunners during preliminary or instruction practice find that they require sight settings differing slightly from the normal, these should be recorded and used.

Finally, careful attention should be paid to loading the ammunition evenly into the belts, so that a belt can pass through the feedway without fouling at either front or rear. This will eliminate a large proportion of stoppages. Careful mounting of guns and tripods as described hereafter, together with care in eliminating play in the elevating and traversing mechanism, will reduce the dispersion of a group to well within the 1-inch diameter of the 500-inch scoring spaces.

DIRECT LAYING

The caliber 0.22 machine gun can be used to advantage during instruction in the parts of direct laying that can be taught on landscape ranges or short field ranges. The details of this type of instruction with caliber 0.30 ammunition are prescribed in the Basic Field Manual, Volume III, Part Three.

With the caliber 0.22 gun a miniature range is an excellent training device. This miniature range (See Figure 29) is simple in construction and possesses certain advantages over the landscape target. Firing on this range resembles service firing more nearly than landscape target firing does. On the miniature range we have the actual strike of bullets in dirt, and thus the gunner's problems approximate that of the field range mainly because of this

TABLE II*

CONVERSION TABLES OF EQUIVALENT SIGHT SETTINGS AND ANGLES OF ELEVATION FOR USE WITH U.S.M.G. CALIBER 0.22, M1

Range	*Angles of elevation caliber 0.22*		*Equivalent setting with caliber 0.30 sight leafs*	
	AE	*Difference*	*Cal. 0.30 1906 sight leaf*	*Cal. 0.30 M1 sight leaf*
(yards)	*(mils)*	*(mils)*	*(yards)*	*(yards)*
(1)	(2)	(3)	(4)	(5)
100	4.7		500	500
		6.0		
200	10.7		850	900
		7.4		
300	18.1		1100	1200
		9.1		
400	27.2		1350	1500
		11.3		
500	38.5		1575	1775
		13.6		
600	52.1		1775	2075
		16.3		
700	68.4		2000	2350
		19.3		
800	87.7		2175	2650
		22.8		
900	110.5			2950
		27.0		
1000	137.5			3300

*Table II is used in the following manner: For example, it is desired to fire the caliber 0.22 gun at a range of 400 yards. In the left hand column of Table I find "400 yards". Column 2 gives an angle of elevation for this range of 27.2 mils. This can be used for indirect laying. If the gun is to be used for direct laying over the sights, consult column 4. Here we find that 1350 is the equivalent range on the caliber 0.30 M1906 sight leaf. Put this on the gun and it will be set for 400 yards. If the new M1 sight leaf is used, take the figure in the last column.

fleeting observation. Furthermore, the shot group is not intercepted and permanently recorded on an easily observed vertical panel. Hence the manipulation required to correct for a range error cannot be made by estimating the deviation of the plainly seen shot group and merely elevating or depressing the muzzle through the same number of mils that the center of impact is observed above or

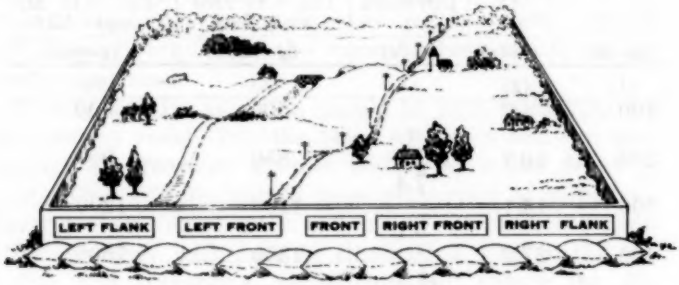

FIGURE 29.—Miniature range.

below the target in inches. The artificial nature of this kind of adjustment is a serious limitation to the use of landscape targets. After all, the machine-gun beaten zone is horizontal, not vertical, and is fleeting in nature, not permanent.

Whether the miniature range or the landscape target is used, guns should be mounted on sandbags at a range of 500 inches. The effect of thus moving the guns to within 500 inches of the target is to double the size of the miniature range or landscape target, since the angular value of its dimensions is thereby doubled.

Guns should be targeted as prescribed for marksmanship, and all targets should be engaged with the sight setting thus obtained regardless of the range announced in the fire order.

If outdoor range facilities are available problems can

readily be fired at ranges up to 500 yards. Here, the sight settings required will be approximately those indicated in Table II.

Where the ground around the targets favors observation, firing of this type gives training in the difficult technique of "sensing" the relation of bullet strike to target. Because of range difficulties and caliber 0.30 ammunition limitations, the training received by the average gunner in this technique is often limited. Caliber 0.22 training can hardly be made an exact representation in miniature of caliber 0.30 field firing. However, considerable realism is added by using sand or dry earth near the targets in order to improve observation.

Inasmuch as the strike of the smaller bullet is smaller and the time of flight longer, the difficulty of fire adjustment of this type approximates that of adjustments at ranges three times as great with the caliber 0.30 gun.

INDIRECT LAYING

The caliber 0.22 machine gun has greatly increased the possibilities of instruction in indirect laying. Using the gun in conjunction with either landscape targets or a miniature range, machine-gun units can be thoroughly and efficiently trained on indoor ranges as short as 500 inches. Moreover, with the exception of the range-finder operator, the ability of all members of a unit is tested under more exacting technical conditions than in firing a field problem at a range of some 4,000 yards.

In the long-range problem with the caliber 0.30 gun, data would be taken by the platoon leader and his detail, using two or more observation posts. This data would then be plotted and computed. Meanwhile, the firing unit would go into position, ordinarily on a reverse slope with a view limited to the crest to the immediate front. Upon order they would lay upon the prescribed aiming point, turn the guns through the base angles, and elevate them

as ordered for firing over the crest to their front. Owing to difficulties of observation the result of such fire can rarely be satisfactorily observed. Even where observation is possible, responsibility for error cannot be determined, since mistakes may be caused by errors in obtaining, computing, or applying data, or by a combination of two or more such factors and the effect of wind and weather conditions.

At 500 inches, on the other hand, the unit receives and executes precisely the same type fire order, and by merely dropping the target cloth mask, the effect of fire upon the target can be observed by all. Individual errors in execution can readily be determined. A very slight error in sighting, for example, results in a relatively large angular error. This demands, therefore, extreme accuracy in obtaining, computing, and applying data. So effective is training of this type that it is safe to say that a unit proficient at the 500-inch range will be able to deliver effective fire at any range.

True, the range-finder operator receives no training in the use of his instrument, and the platoon leader's problem in obtaining data differs slightly from that of a long-range problem; but the instrument detail can readily be given separate and additional training in securing data and plotting long-range problems which are not actually fired. Such training, coupled with the accuracy required and attained during the working of reduced range problems, will result in an instrument detail qualified to take on a firing problem of any type.

In this regard, the technique of indirect laying has recently been revised and simplified. This revision has not yet been officially approved, though its adoption is probable and the new technique is now being used at The Infantry School. Pending official publication, the proposed text has been included complete in Special Text No. 8, Army Extension Courses*, including detailed instructions

*This text can be procured from the Book Shop, The Infantry School.

covering the procedure for conducting short-range problems with caliber 0.30 ammunition. The procedure for conducting similar problems with caliber 0.22 ammunition is given below.

It is assumed that the miniature range will be used, but a landscape target may be employed instead. The platoon task is to bring the fire of its guns on the target marked *X* by indirect laying means. An unknown range of from 400 to 1200 inches can be used though longer ranges may

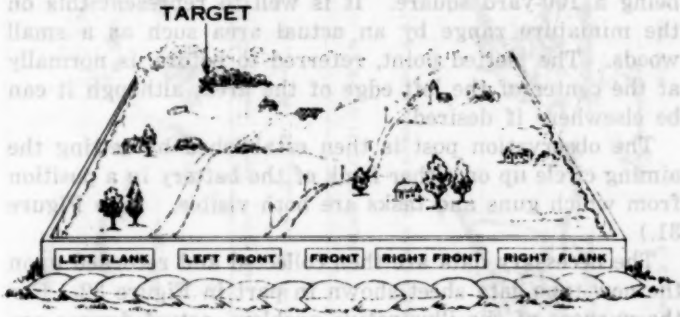

FIGURE 30.—Miniature range, showing location of a specific target.

be used if desired.

Certain preliminary details must be checked before the problem is attacked. A battery of four guns should be set up with the guns numbered right to left. When organizations have less than four caliber 0.22 guns, the other guns may be caliber 0.30. These latter do not fire but go through all the other training and, if desirable, their work can be checked as described in Special Text No. 8. Gun intervals should be reduced to an inch or two, and must be equal. All guns must be on the same horizontal plane. This can be checked by sighting over the traversing dials with the guns and cradles removed. The guns should be carefully targeted and the zero quadrant

elevations obtained and recorded prior to the firing. In front of the guns a target cloth screen is erected representing a mask and concealing the target from the gunners.

The problem is begun by designating the target to the platoon leader. This can conveniently be done by placing a small cardboard square on a tiny stake at the desired point. However, it should be clearly understood that this is merely the plotted point or object to which data will be taken. The reason for this is that fire delivered by indirect means is area fire, the normal target at field ranges being a 100-yard square. It is well to represent this on the miniature range by an actual area such as a small woods. The plotted point, referred to before, is normally at the center of the left edge of the area, although it can be elsewhere if desired.

The observation post is then established by setting the aiming circle up on either flank of the battery in a position from which guns and tasks are both visible. (See Figure 31.)

The necessary data are then collected and recorded upon the new type data sheet shown in part in Figure 32. For the purpose of the illustrative problem, actual figures are assumed. Hereafter the gun will be referred to as *G*, the target as *T*, and the observation point as *O*. G_1 refers to No. 1 gun, and G_4 to No. 4 gun.

Ranges from *O* to *T*, *O* to G_1, and *O* to G_4 are measured using a steel tape in place of a rangefinder. Distances are measured horizontally along the floor or ground from a point directly below the stem of the aiming circle (as indicated by a plumb-bob) to the gun pintle or target as the case may be. The tape must be taut and straight. Ranges are measured in feet and inches, then reduced to inches which are plotted and used as yards. Hence the range: *O-T*, which appears on the data sheet as 870 yards, was actually measured as 72 feet 6 inches.

Obtaining ranges in this manner takes the place of the work of the rangefinder and is the only artificial step in the problem. An additional detail of three men is used

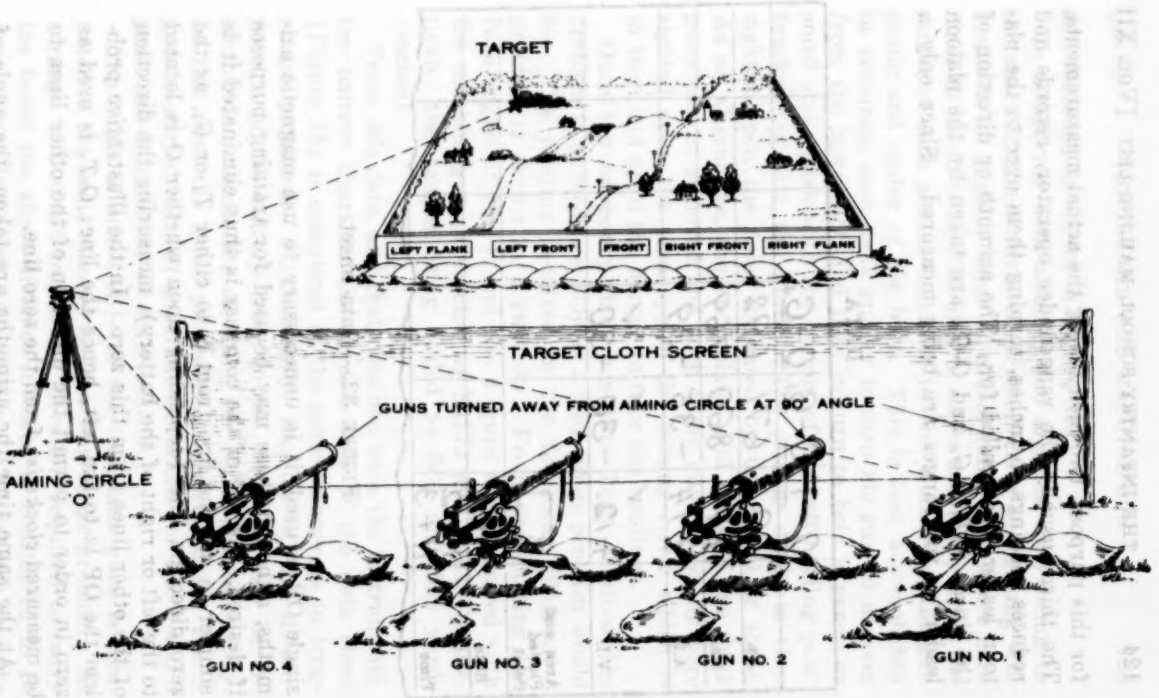

FIGURE 31.—Miniature range indirect laying set-up.

for this purpose, two men taking the actual measurements. The third, usually the rangefinder operator, records and reduces readings to inches, turning them over to the platoon leader when called for. The azimuth or direction of the lines: *O-T*, *O-G*$_1$ and *O-G*$_4$, are taken by the platoon leader as the ranges are being measured. Since only a

DATA

	O-T	O-G$_1$	O-G$_4$			
As.	0	671	692			
Rn.	870	860	769			
A.S.	+14	-35	-39			
V.I.	+12. ✓	-30 ✓	-30 ✓			
Area and Plotted Point	✱					
Rate	R					
Time	H+2 H+3					

FIGURE 32.—Data sheet.

single OP is used, it is unnecessary to use magnetic azimuths, although these may be used for training purposes if desired. As use of the compass is thus eliminated it is simpler to use the line from *O* to either *T*, or *G*$_1$, as the zero direction line (depending upon whether *O* is located to the left or right of the battery), measuring the direction of the other lines from this zero. In the illustrative problem the OP is to the left, hence the line: *O-T*, is used as zero in order to permit the direction of the other lines to be measured *clockwise* from the zero line.

At the same time the azimuths are taken, the angle of site to each of the points *T*, *G*$_1$ and *G*$_4$ is also measured

and recorded as shown in Figure 32.

In measuring both azimuth and angle of site, owing to the short distances involved, a small error in sighting will result in an angular error of considerable size; hence care must be taken to lay the aiming circle accurately upon the center of each gun as indicated by the juncture of the gun pintle and center of the bore. This is best accomplished by requiring each flank gunner to turn his gun 90 degrees from the line: *G-O*, and then in turn to hold a pencil or small stake flush with the bottom of the belt-holding pawl bracket opposite the pintle. The aiming circle is then sighted upon the point indicated by the pencil or stake. As an alternative, the back plates and bolts of the flank guns can be removed and then these guns carefully bore sighted upon the telescope of the aiming circle which is in turn laid upon the muzzle to take the readings.

Once the necessary data has thus been obtained the problem is plotted precisely as a long-range problem would be. The plotting required in the foregoing illustrative problem is shown in Figure 33. From the plotting the base angles of No. 1, and No. 4, guns are measured with the machine-gun protractor as R1272 and R1425 respectively, the ranges being scaled as 560 and 555 yards (inches).

From this data, and that obtained with the instruments, the battery chart on the reverse side of the data sheet (Figure 34) is completed in the same manner as in long-range problems. (Occasionally, because of the disproportion of the battery front to the target, it may be desirable to compute the elevation for No. 4 gun separately. In this case the same procedure as described for No. 1 gun is carried out and quadrant elevations for No. 2 and 3 guns are determined by interpolation.)

The angle of site (AS) for the two flank guns is computed in the same manner as in a long-range problem. At a range of 500-600 inches the elevation required to carry the bullet the short distance involved is considered to be zero; hence the angle of elevation (AE) is zero and the

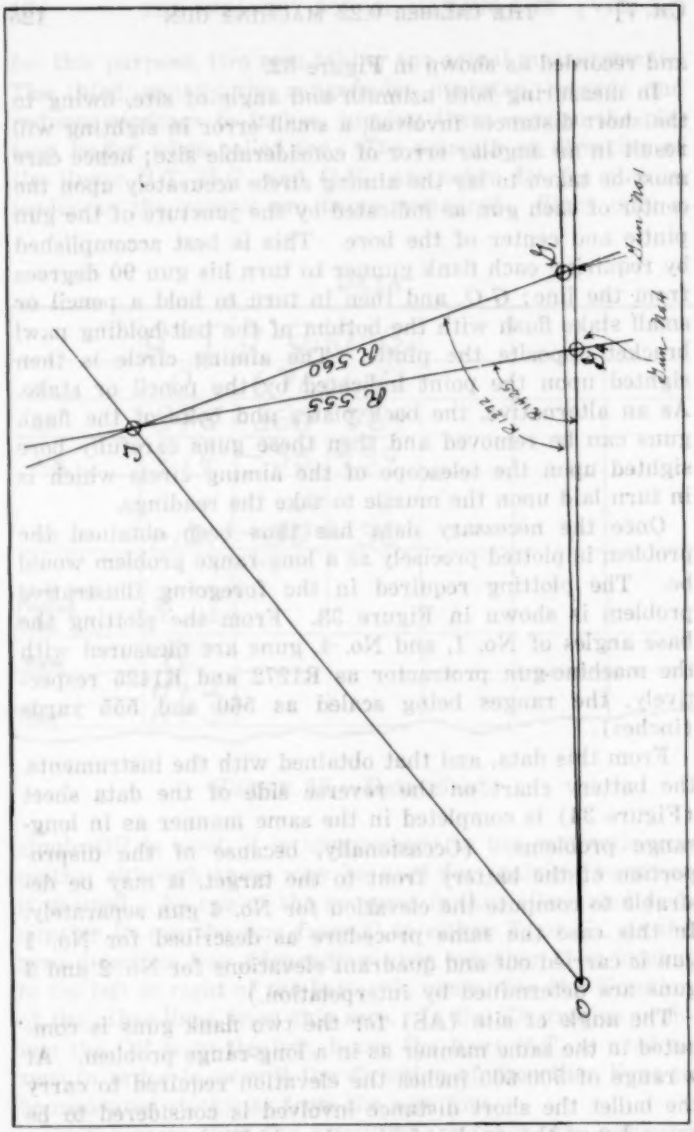

FIGURE 33.—Plotting made from data in Figure 32.

A			TASK			
G_1 —Tgt.	G_4 — ~~Trps.~~ TGT	G — Mask		G —Tgt.	G — Trps.	G — Mask
560			Rn.			
+42			V.I.			
+75			A.S.			
0			A.E.			
75			Q.E.			

I.A.P. Aiming Circle

Base Angles	Lay on I.A.P. Dial	Lay on I.A.P. Add	Gun No.	Angles of Shift	Lay on Base Lines Dial	Lay on Base Lines Add
R1272	R1260	12	1.			
R1323	R1320	3	2.			
R1374	R1360	14	3.			
R1425	R1420	5	4.			

BASE STAKES OUT		FIRE ORDERS	——STAKES OUT
Sight	——		Sight
Lay on Base Lines			Lay on Stakes
Boxes per Gun	1		Boxes per Gun
Quadrant	75		Quadrant
Trav. (R)	12		Trav. (R)
Search UP	——		Search UP
Rate	R		Rate
Time	On Signal		Time

FIGURE 34.—Battery chart.

quadrant elevation (Q) is the same as the angle of site (AS). (In every case the ordered Q should be modified by the application of the zero Q for the particular clinometer before the gun is laid for elevation. For example, if the zero Q of No. 1 gun and clinometer had been determined as plus 3, the Q actually set on the clinometer would have been plus 75 plus 3, or plus 78.) Both direction and elevation for the interior guns are obtained by interpolation.

Required traverse is computed as in long-range problems by the use of the mil formula. For example, in this case, taking the target width as six yards (inches) and the range as 560 yards (inches):

$$\frac{6{,}000}{560} = 11 \text{ mils or (to the nearest multiple of 2) } 12 \text{ mils.}$$

The fire order is issued and the problem fired exactly as in a long-range problem.

In setting base and task stakes indoors, small stakes with a flat base which will permit their standing upon the floor are of advantage.

The mask can be dropped once the guns are laid and before they are fired. If spectators are present, or the unit is being tested, it can be fired once with the mask up and a second time after the screen has been dropped to permit gun crews to observe the fire effect.

In the event of an unsatisfactory result on the part of one or more guns, the application of the ordered fire data should first be checked. If data have been correctly applied, the collection and computation of data should be rechecked to locate the error.

If a 200- or 300-yard rifle range is available, a problem similar to the one just described can readily be fired using a direction of fire straight down the range with an artificial mask or screen in front of the battery. Here, by locating the OP to the flank a distance that will result in ranges of over 400 yards to both target and battery, the rangefinder can be used to obtain ranges instead of the tape.

In problems of this latter type great care and accuracy must be exercised in taking the ranges, since errors of a few yards in range will result in a considerable error in base angle owing to shortness of the range. This is particularly true if an error is made in reading one range and the others are read correctly; since an angle is thus created between the line: *A-T* as computed, and the actual line: *A-T*.

SECTION II

FUNCTIONING AND CARE OF THE CALIBER 0.22 MACHINE GUN

The caliber 0.22 machine gun is actually a Browning Machine Gun Caliber 0.30 M1917, modified to fire caliber 0.22 long rifle ammunition. Where possible, original parts were altered and used. However, new components have necessarily been added to permit utilization of the relatively small operating energy of caliber 0.22 ammunition and to modify the gun for the smaller cartridge. Any tripod that will mount the caliber 0.30 machine gun can be used with the caliber 0.22. It is unnecessary to fill the water jacket although this can be done if it is desired to approximate the weight of the filled caliber 0.30 gun for training purposes.

Despite the greatly reduced force of recoil, efficient operation has been obtained by reducing the 7½-pound weight of the recoiling parts of the caliber 0.30 machine gun to approximately 3¼ pounds, and by increasing the recoil effect of the expanding powder gas by permitting it to act against a greatly increased surface.

Weight has been reduced by constructing the barrel in two sections, a heavy *fixed* barrel together with a light *recoiling* chamber section which telescopes over the rear end of the barrel. Although the caliber 0.30 bolt is used.

its weight has been reduced approximately half by the elimination of all unnecessary bulk.

Increased effect is obtained from the operating energy by seating the cartridge with its casing in the chamber, the bullet proper extending into the fixed barrel. The rear end of the barrel is recessed slightly around the base of the bullet as shown in Figure 35. Thus as the bullet is forced down the barrel a slight leakage of the rearward energy of the expanding gas is permitted. This reacts against the rear wall of the chamber, which is approximately ¾-inch in diameter. This action of the gas pressure against the rear wall of the chamber supplements the direct force of recoil acting through the base of the casing against the face of the bolt. (See Figure 36.)

Other modifications of the caliber 0.30 machine gun are chiefly those involved in adapting the feed mechanism to the use of the smaller ammunition. The most important of these is the addition of an auxiliary feed block, mounted on the trunnion block and held in position by a plunger and spring seated in the bracket of the belt-holding pawl on the left side of the receiver. A small shelf or tray known as the cartridge-belt extractor has also been mounted on the top of the upper rear end of the barrel extension. The rear end of this shelf engages in front of the rim of the leading cartridge. Thus during recoil the necessary rearward pull is exerted against the rim to withdraw the round from the belt. The caliber 0.30 extractor has been modified to exert downward pressure only upon the cartridge; hence it is called the cartridge depressor.

Both gun and parts are disassembled an assembled as are the caliber 0.30 machine gun and its parts with the following exceptions:

FEED BLOCK

Remove by pushing forward on the feed-block retaining plunger using the blade of a combination tool. The feed

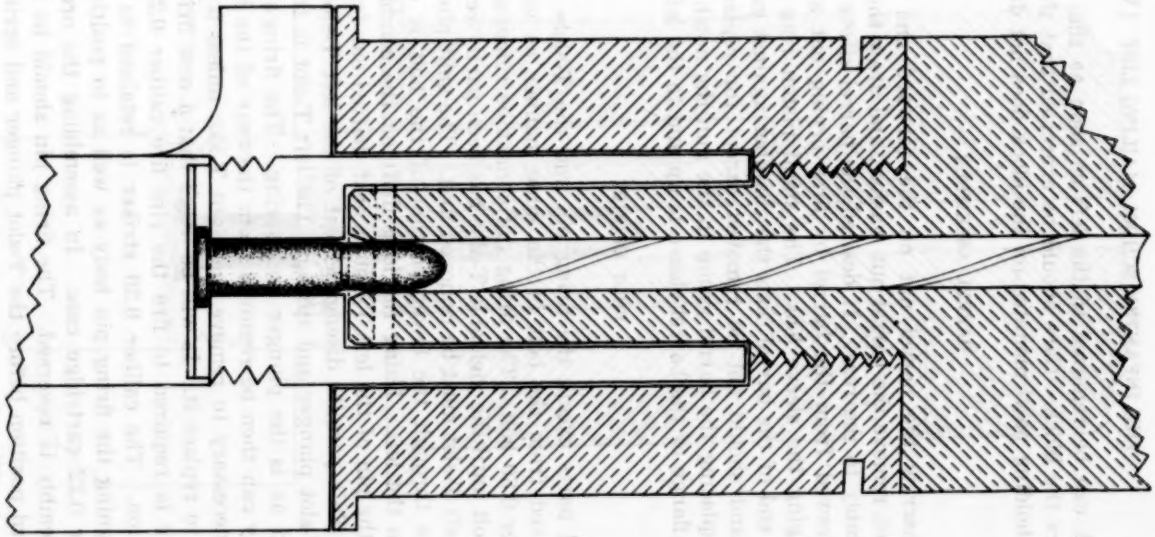

FIGURE 35.—Cartridge in firing position.

block can be removed to the left as soon as the plunger clears the block. Care should be exercised that the small belt-holding pawl mounted on the block does not drop off.

BARREL ASSEMBLY

Unscrew the barrel nut on the forward end of the barrel, remove the barrel nut washer, and draw the barrel assembly to the rear. If desired the barrel sleeve can be unscrewed from the barrel by first prying out and disengaging the sleeve lock. The small piston ring on the rear end of the barrel seals the chamber against gas leakage and should not be removed except for replacement. In replacing the barrel group in the gun the notch on the rear flange of the barrel sleeve is up and to the left.

BOLT GROUP

All parts except the firing pin and the T-slots can be removed from the bolt in the same manner as with the caliber 0.30 bolt. The firing pin cannot be removed from the bolt until the yieldable T-slot has been partly removed. The left T-slot must be removed first. The split pin which passes through the lower portion of the bolt is drifted out to the left. Using the long drift on the combination tool, the pin of the left T-slot is next drifted out from the top. This permits disengagement of the left T-slot from the T-slot plunger and spring. The left T-slot is then removed as is the plunger and spring. The firing-pin assembly can then be removed from the rear of the bolt. It is unnecessary to remove the right T-slot unless it is desired to replace it. It will be noted that a new firing-pin striker is required to fire the rim fire caliber 0.22 ammunition. The caliber 0.30 striker is retained to assist in aligning the firing pin body as well as to position the caliber 0.22 cartridge case. In assembling the order of disassembly is reversed. The firing pin should be in the forward position before the T-slot plunger and spring are replaced. The sharp end of the plunger is to the right.

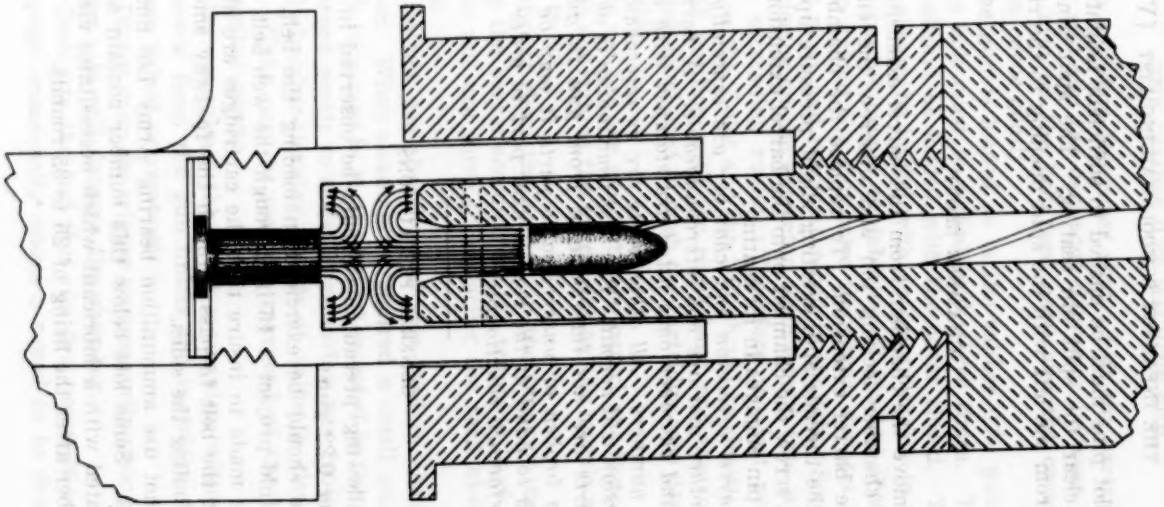

FIGURE 36.—Action of gas against rear wall of chamber.

The T-slot pins must be pushed to sufficient height in the bolt to clear the split pin seating. The split pin is inserted from the left with the split opening to the right or leading.

CHAMBER GROUP

To remove the chamber from the barrel extension, pry out the chamber locking pin and unscrew the chamber from the barrel extension. To replace the chamber, reengage the threads and, exerting slight pressure upon the lock pin, screw the chamber onto the barrel extension until the lock pin engages in its seating.

The barrel extension and chamber are especially fitted to each other and are not interchangeable. A barrel extension and chamber once fitted are stamped with corresponding numbers. All other parts are as interchangeable as the design will permit. The best functioning is obtained when parts are not interchanged from gun to gun. In replacing broken or unserviceable parts it may be found necessary to hand fit the replacement part in order to obtain satisfactory functioning.

GENERAL PRECAUTIONS

The following precautions should be observed in using the caliber 0.22 gun:

1. Care should be exercised in loading the belt. The bullet should project 3/16 in. through the web belt. Test should be made to insure that the cartridges are aligned to permit the belt to pass through the feedway smoothly without fouling the sides.

2. Do not use ammunition bearing Army Lot numbers below *123*. Some lots below this number contain ammunition coated with a lubricant which necessitates cleaning the chamber after the firing of 25 to 35 rounds.

3. Do not slam the cover shut. Lift the cartridge depressor and slip the cartridge depressor between the extension arm on the belt feed pawl and the cover; then close the cover gently.

4. The gun is loaded as is the caliber 0.30 gun except that the bolt must be pulled back *three* times. The gun should always be loaded with the cover closed. The belt should always be loaded with an empty casing in the last loop to permit proper chambering of the last live round.

5. To unload the gun raise the cover, *depress* the belt holding pawl, and remove the belt to the left. Since there is no ejector on the extractor, each empty case is ejected by the succeeding round. Therefore the last round remains on the T-slot and the bolt should be drawn back to the rear position with the right hand and the forefinger of the left hand used to push the cartridge case down from the T-slot.

6. Do not fire the gun with the barrel nut loose.

7. Do not tighten the barrel nut on the muzzle when the barrel is hot.

8. Always clean the seating in the trunnion before replacing the barrel assembly in the trunnion block.

9. Do not use force in replacing the feed block in its seating.

10. Do not use abrasives of any kind in cleaning the chamber. When cleaning is required a small quantity of oil may be placed in it, the barrel reseated in the chamber and turned gently to assist in removing any fouling. The special chamber-cleaning tool is of value in cleaning the spline. Take care to seat the rear end of the barrel in the chamber gently.

11. Do not release the firing mechanism when the bolt is removed from the gun unless the cartridge depressor has been raised or removed.

12. Do not snap the trigger unnecessarily upon an empty chamber. It will damage the chamber.

13. *Owing to the fact that rim fire ammunition is used, a stoppage occasionally causes a round to be fired on the*

trunnion block as the bolt comes forward. Number 2 should therefore be cautioned to keep in rear of the feedway to avoid the danger of being hit by small particles of metal.

SECTION III

MISCELLANEOUS DATA ON CALIBER 0.22 MACHINE-GUN

TO OBTAIN ZERO QUADRANT ELEVATION FOR INDIRECT LAYING OF CALIBER 0.22 MACHINE GUN

Before using the caliber 0.22 machine gun in indirect laying problems, the zero quadrant elevation for the gun must be determined. The method discussed below has proven satisfactory and is recommended.

The guns having been properly emplaced, a blank 3 ft. by 5 ft. target is set up on the miniature range opposite the center of the battery; or, if landscape targets are to be used, two blank panels (upper and lower) are placed in proper relative position to the battery.

Clinometers are then calibrated as follows: The aiming circle is set up directly over the No. 1 gun pintle. With the aiming circle laid upon the target or panel the angle of site scale and micrometer are set at the proper zero for the particular instrument being used, and the angle of site bubble centered by means of the telescope knob. Without disturbing the instrument, a mark is made upon the target at the point where the aiming circle is laid. The operating group is then turned about 20 mils to the left of the first point and a second mark made. These points are then joined by a line representing the horizontal plane of the center of the aiming circle lens.

The vertical distance from the center of the lens to the

center of the bore (as indicated by the bottom of the belt-holding pawl bracket) is accurately measured, care being taken that the gun itself is approximately horizontal. A second line is then drawn upon the target or panel, parallel to the first one and the same distance below it that the barrel is below the lens of the aiming circle. Aiming pasters for each gun are then placed so that their bottom edge is flush with the lower line. All guns of the battery then adjust on their respective pasters by firing. Once adjusted, Q's are read, with care not to disturb the laying. These readings are accepted as zeros for the respective guns and clinometers. Assume that the four zero readings obtained are as follows:

No. 1 gun	Plus 2
No. 2 gun	0
No. 3 gun	Plus 1
No. 4 gun	Minus 1

An announced Q of plus 8 would be set off as follows:

No. 1 gun	Plus 10
No. 2 gun	Plus 8
No. 3 gun	Plus 9
No. 4 gun	Plus 7

In taking readings with the clinometer it is essential that all readings be taken with the clinometer in the same position. A position on the top of the water jacket, with the rear edge of the clinometer flush with the rear edge of the jacket, gives the most accurate results.

The last bursts fired in obtaining the zero Q's are used to target the guns as in machine-gun marksmanship. Thereafter in laying upon stakes, (for landscape target or miniature range firing) sights should be set at the zero thus obtained, in order to avoid lateral error caused by the offset of the sight leaf.

THE SANDBAG BASE FOR CALIBER 0.30 OR CALIBER 0.22 MACHINE GUN

The machine gun is a weapon capable of prolonged and accurate overhead fire largely because of the stability

FIGURE 37.—Tripod mounted on sandbag.

afforded by its fixed mount. In spite of this stability the vibration caused by the rapid succession of explosions tends to increase the dispersion. This is due not only to

the actual vibration of the barrel but also to a "pile-driver" tendency of the trail or rear leg to dig itself in thus causing the barrel to be elevated higher and higher with each successive burst.

To avoid this various means have been used in the past. the most common method being the use of wooden T-bases. It was originally contemplated that these would

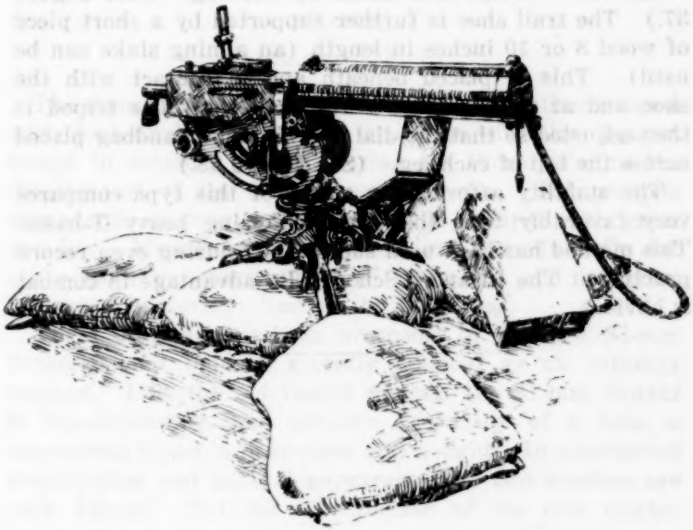

FIGURE 38.—Gun mounted ready to fire.

be of 2 x 6 in. lumber but in an attempt to afford greater stability lumber as heavy as 8 x 8 in., and even concrete bases, have been used.

Bases of this type are objectionable not only because their use in combat would be absolutely impracticable but because the very weight and hardness of the T-base defeats its purpose since it results in turning the vibration back in to the tripod and gun.

Recently there has been developed at The Infantry

School a gun base which is simple and efficient and, moreover, one that would be readily available under combat conditions. An ordinary sandbag is filled about two-thirds full of firm soil or sand; the top folded under and the bag laid upon its side. With the pintle socket resting on the bag, the tripod is forced or pounded well down into the sand so that the front feet of the tripod rest lightly on the ground, in such fashion that the greater part of the weight and vibration is taken by the bag. (See Figure 37.) The trail shoe is further supported by a short piece of wood 8 or 10 inches in length (an aiming stake can be used). This is placed beneath and in contact with the shoe and at right angles to the trail leg. The tripod is then adjusted so that the dial is level and a sandbag placed across the top of each leg. (See Figure 38.)

The stability afforded by a rest of this type compares very favorably with that obtained using heavy T-bases. This method has been used successfully during even record practice at The Infantry School. Its advantage in combat is obvious.

CHAPTER 8

The New Infantry Mortar

(INFANTRY SCHOOL TEACHINGS ON THE NEW 81-MM WEAPON)

The demand for an organic infantry supporting weapon with high-angle fire, which would be effective against troops in defilade, resulted during the World War in the development of the 3-inch trench mortar. This weapon was simple of construction and could be fired with great rapidity. Moreover, its projectile was powerful. On the other hand its short range of 750 yards and its great dispersion materially limited its usefulness.

These defects have been overcome in the new 81-mm Stokes-Brandt mortar, recently adopted as an infantry weapon. Like the old trench mortar, the 81-mm mortar is muzzle-loading, and consists essentially of a tube, a supporting bipod, a base plate and a sight. In mechanical construction and general appearance the two mortars are very similar. But the effectiveness of the new mortar is amazing to those who, like most of us, still think of a muzzle loading mortar as an antiquated, crude weapon.

Its accuracy is great. The probable error at any range is about 1/200 of the range in distance and 1/400 of the range in deflection. This means that, at 1,000 yards for example, the probable error is approximately 5.0 yards in distance and 2.5 yards in deflection, a remarkably small dispersion. Thus the mortar is definitely a precision weapon.

Two different projectiles can be fired—a light and a heavy. It fires the light projectile, weighing 7.7 pounds,

to the extreme range of 3280 yards and the heavier projectile, weighing 14.3 pounds, to an extreme range of 1300 yards.

The mortar also has a very accurate sight, which gives precision in laying for direction and elevation. The base plate does not have to be dug in before firing; hence the weapon can be placed in battery rapidly on any ground. This same advantage gives it great flexibility in traverse. The rate of fire is also high. The normal firing rate is 18 to 20 rounds per minute. A rate of 30 to 35 rounds per minute may be reached in emergencies.

DETAILS OF THE MORTAR

THE TUBE

The mortar tube is a forged and bored steel tube without rifling. It terminates in a base cap which is hollowed and threaded to screw on the tube. A shoulder in the cavity of the base cap bears tightly against the end of the tube to prevent gas leakage. A ball is formed on the end of the cap to fit in a socket of the base plate. This ball is flattened on two sides, so that when it is entered in the socket of the base plate, and the tube is rotated 90 degrees, the mortar and base plate are firmly locked together. The base cap is bored and threaded axially to receive the firing pin, the point of which protrudes through the base cap just far enough to fire the propelling charge. The length of the mortar tube is 49.8 inches and its weight is 44.5 pounds.

THE MOUNT

The mount is comprised of two main assemblies, the bipod assembly and the base plate.

The bipod consists of two tubular-steel legs supporting the elevating, traversing, and shock-absorbing mechanisms

and carries a mount for the sight. Changes in deflection are made by means of a horizontal screw moved by a hand wheel. The horizontal field of fire from one position of the mount is: 130 mils at 45 degrees, 145 mils at 60, and 210 mils at 90 degrees elevation. A vertical screw, which moves in a guide tube under the action of a crank, allows

FIGURE 39.—The 81-mm mortar.

aiming in elevation. The field of fire in elevation is from 40 to 90 degrees. The shock absorber, a double-acting disconnector with springs, allows the mortar to recoil when a shot is fired, and then return to battery, without disturbing the supporting mount or the delicate parts of the sight, which remains in position during firing. The mortar tube is secured to the bipod by a clamping collar, on the upper half of which is a range-table plate for the light shell. The bipod weighs 46 pounds.

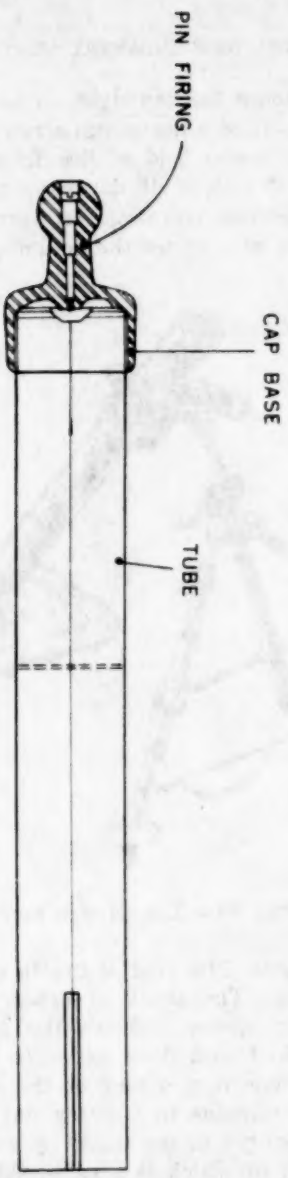

FIGURE 40.—The mortar tube.

The base plate is of swaged steel. On its upper side is mounted a central block containing three sockets that have lugs for seating and locking the spherical end of the base cap. On the under side are a series of strongly braced ribs which insure anchorage to the ground. If, during firing, the plate sinks into the ground too much in front or rear, the seat of the spherical end of the base cap can

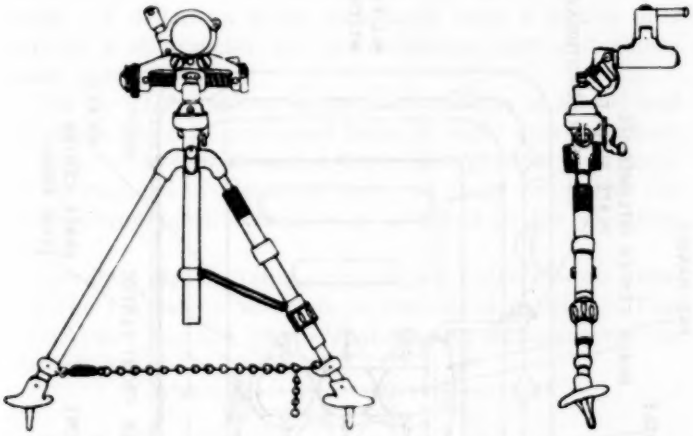

FIGURE 41.—The mortar bipod.

be changed, thus causing the plate to resume its normal position. The weight of the base plate is 43.5 pounds.

THE SIGHT

The far greater effectiveness of the new mortar is due largely to its sight and its ammunition. The sight, which is strongly made, has been adjusted with great care. It is mounted during firing in a sight bracket on the left side of the bipod yoke. Its essential parts are: a device for laying in direction; a device for laying in elevation; and a

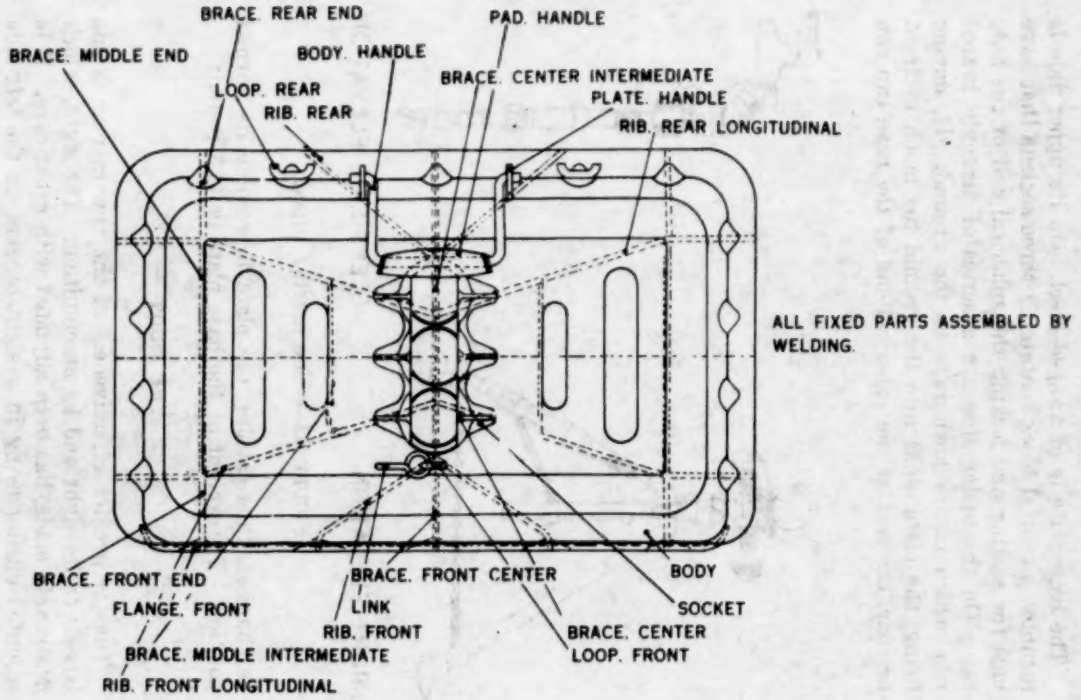

FIGURE 42.—The mortar base plate.

cross level and a collimator for determining minimum elevation.

The device for laying in direction consists of a deflection scale, on which a reference mark is engraved. The scale is graduated from 0 to 6400 mils in units of 200 mils each. A control head, which can be raised and turned in a horizontal plane for setting of deflections in multiples of 200 mils, contains a collimator that can be moved in a vertical plane for convenience in laying on an aiming point. A deflection drum, graduated from 0 to 200 mils acts as a micrometer for the deflection scale and allows close adjustments.

The device for laying in elevation consists of a level and an elevation scale, graduated from 40 to 90 degrees, which is operated by a micrometer drum, also graduated in units of 30 minutes of elevation each. A fixed collimator for determining mask clearance is attached to the elevation scale.

The sight also contains a cross level, which insures keeping the traversing screw in a horizontal position. This adjustment is made by manipulating an adjusting nut on the left leg of the bipod.

MORTAR AMMUNITION

The ammunition is classified as light and heavy shell. The light shell is bi-ogival in shape. Its head is swelled to form a band that fits accurately into the bore of the mortar. The shell tapers toward the tail, which is tubular and has a set of fins to insure stability in flight. Its main characteristics are as follows:

Weight: 7.16 pounds.

Maximum range: 3280 yards.

Minimum range: 100 yards.

Explosive content: 1 pound (approximately) of TNT.

Effective radius: About 25 yards. (Approximately that of the 75-mm high-explosive artillery shell.)

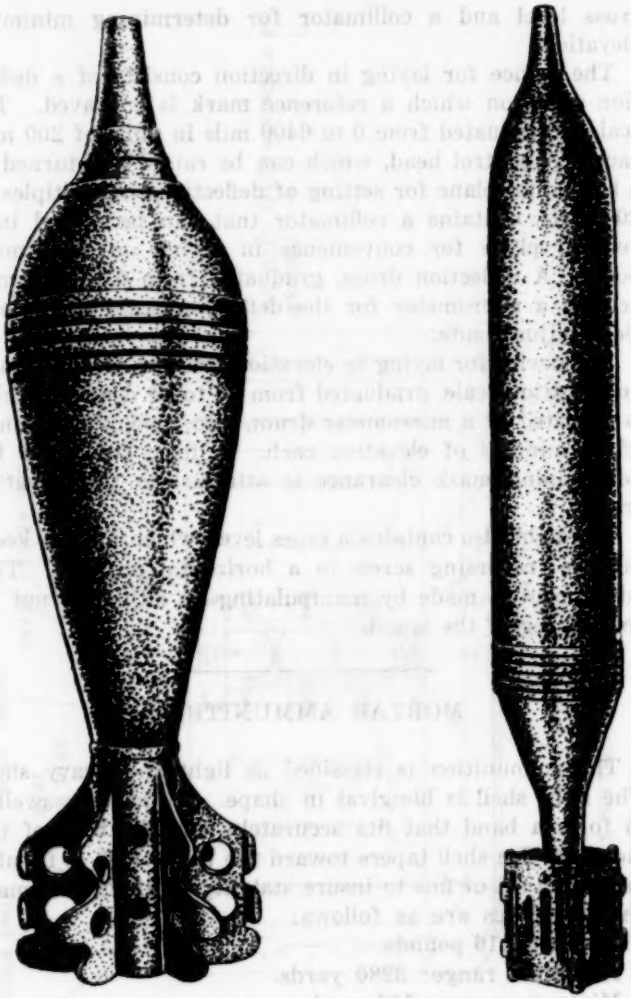

FIGURE 43.—Mortar ammunition.

The heavy shell has the same outer shape as the light shell, but it is much longer. Because of its small diameter as compared with its weight, it has considerable penetrating power against strongly constructed field works. Its main characteristics are as follows:

Weight: 15.12 pounds.
Maximum range: 1300 yards.
Minimum range: 100 yards.
Explosive content: 4.4 pounds (approximately) of TNT.
Effective radius: About 45 yards.

Both types of shell have a fuse that can be set for either instantaneous or delayed action. Both produce a circular sheaf of very deadly fragments. The heavy shell, particularly, gives results against personnel and materiel that heretofore could be obtained only by the use of heavy rifled artillery.

In addition to the two types of shell just described, practice and smoke shell are also made.

COMPANY ORGANIZATION

In the new infantry regiment now undergoing service test (described in Chapters 1 and 2, Volume XI of the Mailing List), the mortars are all grouped in the "Mortar Company", which is in the 4th Battalion. Company headquarters contains the reconnaissance, administration, and supply personnel. In addition, there are three platoons, each consisting of a mortar section and an ammunition squad. The mortar section consists of two mortar squads. Thus the company has six of the new 81-mm mortars. The company is also motorized, and, in addition, each mortar squad has a light hand cart for transporting the mortar and ammunition.

TACTICAL EMPLOYMENT OF THE MORTAR COMPANY

(ILLUSTRATIVE PROBLEM)

Because of its long range and accuracy, the new mortar is capable of taking over almost all of the missions previously assigned to the 37-mm gun—except anti-tank missions—, as well as those of the old 3-inch trench mortar. If the mortar is centrally located its fire is sufficiently flexible to cover the front of a regimental zone of action. Consequently it can be employed effectively in a battery of six mortars. In the attack the battery displaces forward by truck when necessary and is supplied with ammunition by truck. Hence it can, in most situations, quickly concentrate its fire in support of any assault battalion. As the attack progresses and the advance of front-line units becomes rapid and the front irregular, the need for supporting fire will often make it necessary to assign mortar platoons in direct support of rifle battalions, or even attach them outright.

In the situations which follow, a few of the possible methods of mortar company employment are indicated. These are not standard methods, to be applied indiscriminately. They are simply methods that seem best suited to meet the tactical situations described. Neither is the sequence of action by the mortar company, as outlined, a standard sequence. Consequently the reader must avoid any idea that he has here a formula which will fit all situations. Variations in the situation dictate variations in the employment of the mortars. Here we merely show two possible methods of employment and indicate briefly the reasons for their use.

FIRST SITUATION

The Blue 1st Infantry, an interior regiment, is preparing to attack. Its initial objective is the hostile position indicated by the line of combat groups on hills

A to *E*. (See Figure 44.) The regiment has the direct support of a battalion of light artillery.

The regimental commander has decided to attack with the 1st and 2d battalions in assault, 1st Battalion on the

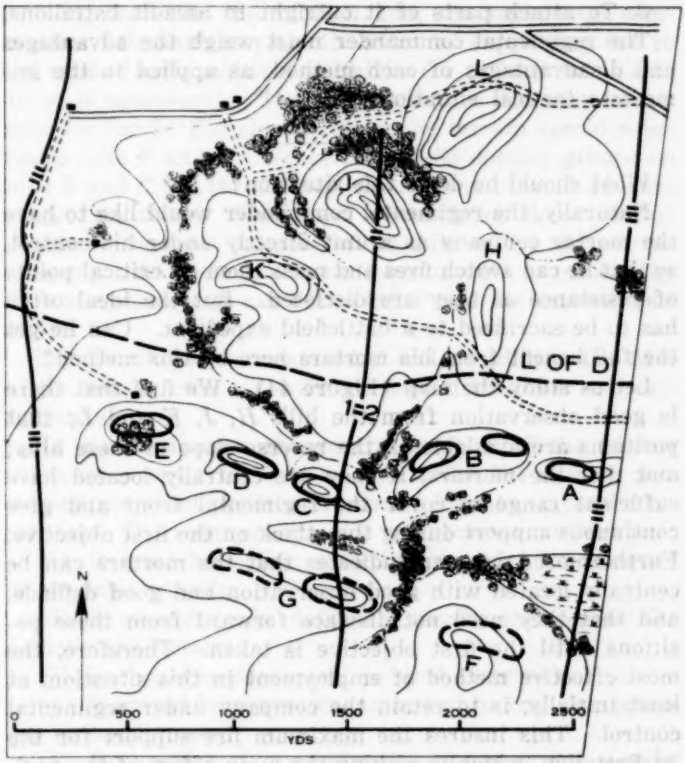

FIGURE 44.—Mortar company in an attack.

right, and to make the main effort of the regiment in the zone of action of the left (2d) Battalion. Although he must carefully calculate how he will employ all the weapons of his 4th Battalion to advance the attack, we are here interested only in how he employs the mortar company.

There are three general ways to use the mortar company. These are:

1. To retain it under regimental control.
2. To place parts of it in direct support of assault battalions.
3. To attach parts of it outright to assault battalions.

The regimental commander must weigh the advantages and disadvantages of each method, as applied to the immediate tactical situation.

What should he do in this situation?

Naturally, the regimental commander would like to have the mortar company as a unit directly under his control, so that he can switch fires and mass them on critical points of resistance as they are disclosed. But the ideal often has to be sacrificed to a battlefield expedient. Can he get the full benefit from his mortars here by this method?

Let us study the map (Figure 44). We find that there is good observation from the hills *H, J, K* and *L;* that positions are available on the reverse slope of these hills; and that the mortars, if they are centrally located have sufficient range to cover the regimental front and give continuous support during the attack on the first objective. Furthermore, the map indicates that the mortars can be centrally located with good observation and good defilade, and that they need not displace forward from these positions until the first objective is taken. Therefore, the most effective method of employment in this situation, at least initially, is to retain the company under regimental control. This insures the maximum fire support for the 2d Battalion, which is making the main effort of the regiment, and does not relinquish the advantage to be gained by the flexibility of the mortar fire if a temporary reverse requires mortar assistance elsewhere.

The decision then should be to use the mortar company as a unit under regimental control.

But where shall we locate the mortar positions? The initial positions depends to a considerable extent upon the initial mission. The regimental commander gives out this mission in his attack order for the 4th Batttalion. In this situation, where the principal effort of the regiment is being made by the 2d Battalion, the regimental commander will want to place the mass of supporting fire in the zone of action of that battalion (or at least be able to do so if necessary). The most favorable direction of attack for the 2d Battalion is down the terrain corridor between hills *B* and *C*. Hence the hostile combat groups on hills *B* and *C* are the greatest obstacles to a rapid advance along this route. Therefore, neutralizing these combat groups is the most suitable initial mission for the mortar company. As soon as fire on these targets is masked by advancing troops, it can lift to hill *F* and the eastern spur of hill *G*.

The 4th Battalion commander will coordinate the fires of the mortar company with the fires of the other supporting units.

He also designates the general location of the mortar company in order for it to be able to fire the mission prescribed; its exact position is selected by the company commander. The requirements of a good mortar position are:

(1) It must be within effective range of its assigned or probable targets.

(2) It should be in defilade (usually the deeper the defilade the better).

(3) It should be convenient to good observation.

(4) It should be convenient to a road or trail for bringing up ammunition.

(5) It should have concealment, subject to the restriction of (1) above.

It is usually preferable to locate the mortars from 500 to 800 yards in rear of the line of departure; sometimes even farther back, so that they have the maximum protection from hostile counter-preparation fires.

In this regard it must be remembered that "maximum"

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effective range", as applied to the mortar—which is usually considered as 1800-2000 yards—, is based on the possibility of observation and adjustment of fire, and should therefore be measured from the observer's position, not from the mortar position.

In the present situation there are several good initial positions. The draws between hills *K* and *J* and between hills *J* and *L* are suitable. But the draw between hills *J* and *L* is more central to the main effort and the targets, hence is better, and should be selected. The mortars should be sited on the north and northeast of hill *J* with enough distance between them to insure that one burst of an enemy shell will not catch more than one mortar. The ammunition squads should be located along the road north of hill *J*, convenient to their platoons. Fire will be observed and adjusted from the crest of hill *J*.

This is one solution under the conditions of the situation. But change the situation slightly and the solution will also differ. To make the point clear suppose we have the company operating over the same terrain, with the same regimental boundaries and against the same points of resistance. But let us modify the situation otherwise, and then determine how we should use the mortar company. Accordingly, let us consider the second situation.

SECOND SITUATION

The Blue 1st Infantry, an interior regiment has been attacking south since daylight. The boundaries and locations of leading elements are shown in Figure 45. The regiment has repelled a strong local counterattack, and it is now, at 1:00 PM, about to renew the attack against an enemy who is more than a little shaken. The reserve battalion (the 3d) is to be thrown in attacking in the left (east) battalion zone. The regimental commander has directed this reinforcing battalion to push its attack to the objective—the high ground at *F*—without regard to

the attack of the 1st Battalion on its right. The 1st Battalion is to assist the attack of the 3d Battalion by capturing hills *C* and *D*.

The mortar company, now under regimental control, has

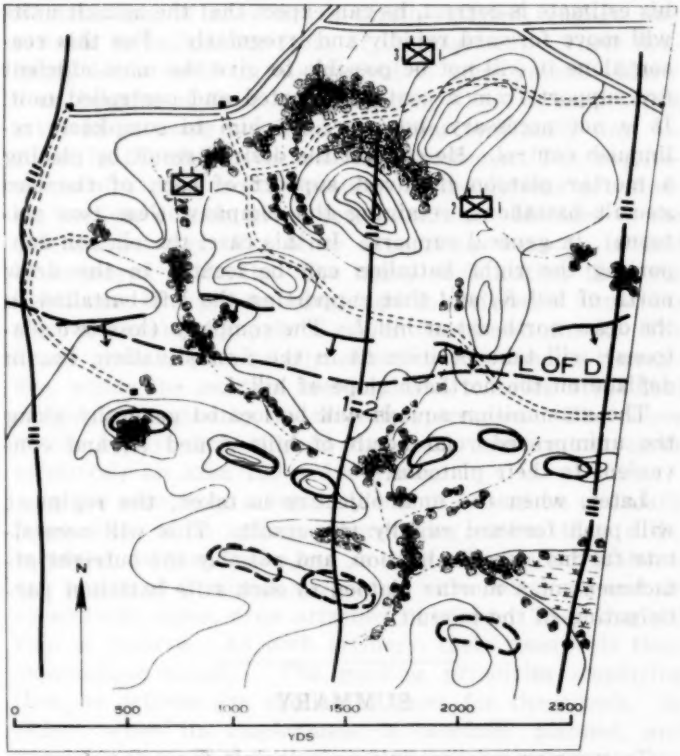

FIGURE 45.—Mortar company in attack (second situation).

been firing from positions generally 900 yards northwest of hill *L*. It is preparing to displace forward.

Will this particular situation, which has many points of similarity to the first situation, make any difference in the employment of the mortar company? Let us see.

Since the attack is to be pushed to its conclusion by the reserve batttalion without regard to the atttack of units on its right and left, and since the enemy is somewhat shaken, the regimental commander should begin to decentralize the control of his supporting weapons. For if his estimate is correct, he can expect that the assault units will move forward rapidly and irregularly. For this reason alone it will not be possible to give the most efficient fire support from a centrally located and controlled unit. It is not necessary, however, for him to completely relinquish control. He can get the desired result by placing a mortar platoon in direct support of each of the two assault battalions, retaining the company (less two platoons), in general support. In this case, the platoon supporting the right battalion can be located in the draw north of hill *K*, and that supporting the left battalion in the draw northeast of hill *J*. The company (less two platoons) will take position as in the first situation, i.e., in defilade on the northern slope of hill *J*.

The ammunition squads will be located generally along the unimproved road north of hills *J* and *K*, and convenient to their platoons.

Later, when the final objective is taken, the regiment will push forward rapidly in pursuit. This will necessitate further decentralization, and possibly the outright attachment of a mortar platoon to each rifle battalion participating in the pursuit.

SUMMARY

To summarize: The guiding principle for using mortars in an attack is to hold them under centralized control, when the terrain and the tactical situation permit, so that the regimental commander can employ their flexibility and firepower to take advantage of rapid changes in the situation, and thus directly influence the action. But when centralized control becomes difficult, elements of the mortar company should be placed in direct support of

rifle units, or attached outright when a rapid advance, wide separation of units or probable failure of communications make the other methods of employment impractical.

In the defense the mortar company will usually operate in general support of the regiment. As we saw above, the mortars can, if they are centrally located, engage any suitable target on the front of the regiment. Their flexibility lends itself to this method of employment. Moreover, because of their high trajectory there is no problem involved in using overhead fire from practically any position in the defensive area of a regiment. The requirements of a good mortar position in the defense are similar to those already given for the attack. Mortars in the defense, however, like other supporting weapons, should be employed in depth. The heavy shell, rather than the light, can be used to advantage in defensive situations since ammunition supply is easier than in an attack. The heavy shell is particularly effective for close-in barrage fire, where the mortars are employed to cover areas that cannot be reached by flat-trajectory weapons. The power of the heavy shell is such that each mortar can cover effectively an area 100 x 100 yards.

In the event that a regiment has to defend an unusually large area, or in actions where delay rather than a determined defense is the end in view, the mortar platoons can be placed in direct support of rifle battalions and, in exceptional cases, even attached outright. They are not held in reserve. As with artillery, their reserve is their ammunition supply. The guiding principles employing them in defense are similar to those for the attack. In either, when its employment is carefully planned, and provision is made for its close liaison with rifle units, the mortar company brings the power of artillery directly under the control of the infantry commander.

CHAPTER 9

The Motorized Attack at Zytomierz

(AN INFANTRY SCHOOL HISTORICAL STUDY)

The present trend to motorize and mechanize armies brings many problems for the soldier to solve for which he unfortunately has few precedents to follow. The World War, in spite of its manifold aspects, helps him little, because its essential aspects were those of a siege. Motors, it is true, were used in vast numbers but actually they amounted only to flexible railroads rapidly shifting troops in rear of the line. There was little, if any, use of a motorized force as a tactical unit in an open situation. Small units did not rely on the speed of motors to accomplish a tactical task. Motors merely brought troops to a certain point and left them there to function in their time-honored manner. We did, indeed, gain from this a fair idea how motors can be used in a strategical way, but not how they can be used tactically.

How can we combine the speed of motors with the attributes of infantry to produce a tactical result? In the past soldiers combined the horse and the man and produced a tactical instrument called cavalry. But now our problem is to combine the man and the motor into a single tactical instrument. And the World War did not furnish the answer.

On the other hand we cannot apply the experience of the Italians in Ethiopia, for the operations there are too recent to present a clear picture of the methods used. However, it is plainly apparent from newspaper and of-

ficial accounts that motorized and mechanized units have played a big role in Italian success, regardless of the fact that the theater of the war is largely unfavorable for realizing the full advantages of their mobility.

The great enigma, then, which faces the modern infantryman is not one of facilitating supply and transportation in areas out of contact with the enemy, but one of merging motors and foot troops on and near the battlefield so that the speed of the motors can be fully utilized for increasing the effectiveness of infantry.

Tactically, infantry obtains results by movement and fire. Hence our problem finally resolves itself into ascertaining how we can use motors to accelerate infantry movement. We have, of course, used motors to augment infantry movement and firepower, and have added shock action; the result we call a tank. But the truth is that we have only developed one more weapon, leaving still unsolved our primary problem.

Is there, in fact, *any* historical operation that indicates a way of using motors to improve the tactical movement of infantry? Yes, there is. And strange to say it occurred during a war fought in an agricultural country by two agricultural nations, and not a war fought in an industrial area by two industrial nations. It was the Russo-Polish War of 1920.

Reviewing this campaign briefly we find the Poles, despite the paucity of roads and mechanical vehicles, and the disorganization and destruction of roads and bridges incident to six years of warfare, combining infantry and motors with excellent results. And this not in a mere skirmish or isolated flanking action but in decisive thrusts. One of these actions was at Zytomierz.

Oddly enough the motor attack at Zytomierz has been called by many writers a raid. It was anything but a raid. A raid in the military sense denotes a rapid dash into enemy territory, the accomplishment of some mission

there, and then a sudden retirement. Such were the trench raids of the World War and the cavalry raids of our Civil War. Certainly we cannot call a rapid movement to take and hold a key locality a raid. Particularly is it a misnomer for the Zytomierz action, for there the entire maneuver of the main force had the purpose of opening a way for the motor force to secure the key position, and success for the main force depended on getting this position. The choice of "raid" as the category for this operation was particularly unfortunate, because it conceals under a time-worn name a new type of operation —the use of motors to facilitate infantry battlefield movement.

The Russo-Polish War has had slight attention from military writers mainly because the World War overshadowed it, and perhaps, also, because it has been assumed that the Russians, imbued with the Revolution and its doctrines, implying revolt against discipline, were without great fighting ability. But when it is realized that in the Russian Civil War the Soviet Army defeated five White Russian armies all backed, more or less, by some European power, it can be seen that the Soviet army was no puny weakling. Its methods may have been unorthodox but it had already done strenuous fighting and was to do more against the Poles.

Moreover, aside from the temper of the Russian army, we have here in this theater the first chance to observe World War weapons used in giant scale open warfare. Fronts were not continuous trench lines and they were thinly held. Maneuver was possible. It looked like an ideal setting for either side to strike a smashing blow, break through, and then exploit the break-through with cavalry masses. Yet strangely enough, in this ideal cavalry country where wheeled traffic was difficult, motors stepped to the front and stole the show.

THE POLISH-RUSSIAN SITUATION IN THE SPRING OF 1920

In the spring of 1920 the Soviet Government announced that having destroyed the White Russian Armies it was now going to turn its attention to the West and settle the Polish question once and for all. As Soviet leaders explained, they were going to carry the Workers Revolution to central Europe across the corpse of Poland. Thus forewarned, the Poles planned an offensive of their own toward Kieff.

Toward the end of April the line held by the contending armies was as shown in Figure 46. On both sides divisions varied greatly in strength but probably averaged about 9,000 men. The Russians held the front with comparatively small forces in intrenched positions and with reserves well to the rear at critical points. The intrenched front, as mentioned above, was not continuous.

The Soviet front fell roughly into three parts. In the north the group based on Korosten was relatively weak. A strong center group was based on Zytomierz-Berdyczow. This group held its front strongly but not at the expense of its reserves whicch were massed in the Zytomierz-Berdyczow area. The equally strong southern group, with its base at Winnica and Zmerynka, held its front with weak forces but had very strong reserves.

From the above it can be seen that the Poles had no Russian flank to envelop. A flank had to be made. This meant a penetration and the rolling up of the interior flanks. However, merely breaking a gap in the thinly held front and trying to exploit the local success would be of little value, for the Soviet reserves would have plenty of time in such a case to counterattack and perhaps defeat the Polish offensive. For success, the attack must create a deep penetration, involve the reserves almost at the outset, and thus prevent their maneuvering for a counterattack or taking up a defensive position to cover critical points.

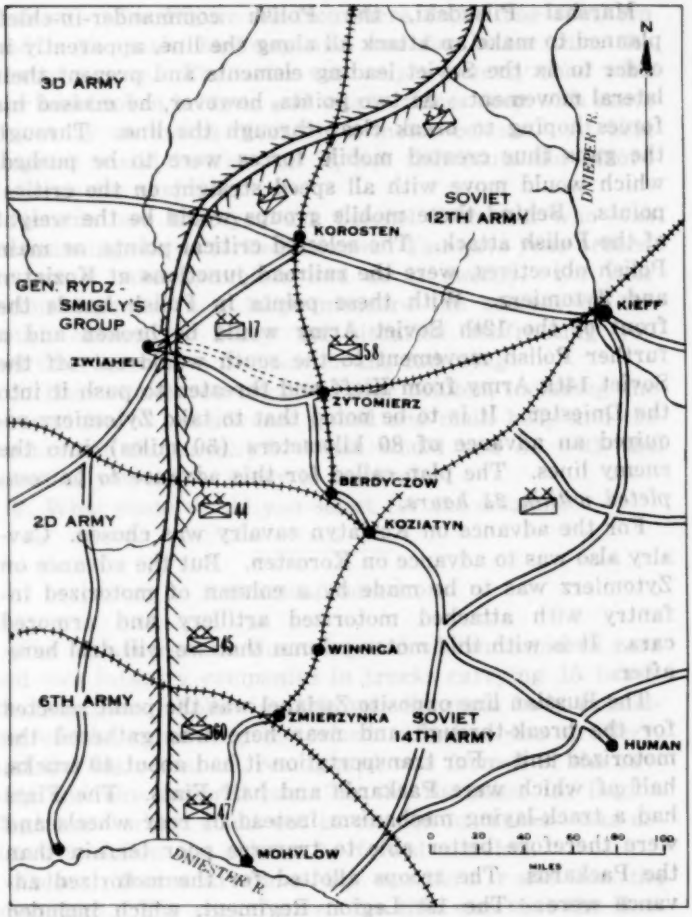

FIGURE 46.—The Polish-Soviet front prior to the Polish advance on Kieff.

Marshal Pilsudski, the Polish commander-in-chief, planned to make an attack all along the line, apparently in order to fix the Soviet leading elements and prevent their lateral movement. At two points, however, he massed his forces hoping to break clear through the line. Through the gaps thus created mobile forces were to be pushed, which would move with all speed straight on the critical points. Behind these mobile groups would be the weight of the Polish attack. The selected critical points, or main Polish objectives, were the railroad junctions at Koziatyn and Zytomierz. With these points in Polish hands the front of the 12th Soviet Army would be broken and a further Polish movement to the south would cut off the Soviet 14th Army from Kieff and threaten to push it into the Dniester. It is to be noted that to take Zytomierz required an advance of 80 kilometers (50 miles) into the enemy lines. The plan called for this advance *to be completed within 24 hours.*

For the advance on Koziatyn cavalry was chosen. Cavalry also was to advance on Korosten. But the advance on Zytomierz was to be made by a column of motorized infantry with attached motorized artillery and armored cars. It is with this motor column that we will deal hereafter.

The Russian line opposite Zwiahel was the point selected for the break-through and near here was gathered the motorized unit. For transportation it had about 40 trucks, half of which were Packards and half Fiats. The Fiats had a track-laying mechanism instead of rear wheels and were therefore better able to traverse poor terrain than the Packards. The troops allotted for the motorized advance were: The 1st Legion Regiment, which included two infantry companies carrying 15 heavy machine guns, a company of engineers, a troop of cavalry, a battery of motorized artillery, and a platoon of 3 armored cars. There were not enough trucks for all the infantry. Roughly one battalion could not be carried.

Two roads lead from the vicinity of Zwiahel to Zy-

tomierz. (See Figure 47 from here on.) The southern road is the main highway and was far better than the northern route. The latter was only a country road with poor and broken bridges, and was in places deep with sand. It was by no means ideal for a motor column. At best progress would be slow on it, but this route did afford a chance for surprise.

Assume now that you are Colonel Biernacki who was commanding the motorized column. You have your orders. You must take Zytomierz and do it swiftly. On your action depends in a large measure the success of the Polish offensive. Study the situation confronting you and then come to a decision on the following:

1. How would you organize your column, including the composition of the advance guard and main body and the position of the cavalry? What would you do with the battalion you cannot carry in motors?
2. What route would you select for the column?

HISTORICAL SOLUTION

The advance guard was composed of two armored cars and two infantry companies in trucks carrying 15 heavy machine guns. Following this was the main body consisting of the remaining motorized infantry, the artillery, and the engineers. A rear guard was formed of the cavalry and one armored car. The 3d Battalion 1st Legion Regiment—which could not be carried in trucks—was ordered to follow the column by forced marches.

Colonel Biernacki chose the northern route for the movement. The reason given for this was that the Russians would hardly expect a motorized column to come over this road when a far better one paralleled it to the south. Surprise was the aim. Although nothing is said in accounts of this operation about the Russian organization for defense along the southern route, it was here that the Russians might logically be expected to do the most

ground organization. This may well have entered into the decision.

At dawn 25 April the attack was launched. Polish front-line infantry battalions broke through the Soviet line east of Zwiahel near the town of Niesilon and vigorously pursued the Russians. Through the gap thus created the motorized column rolled forward in its war-time vehicles. It was followed by the 3d Battalion 1st Legion Regiment doing the best it could on foot. This battalion was soon rapidly outdistanced and lost to the column. By 6:15 AM the motor column passed the Polish assaulting troops who were pursuing the Russians near Lagulsk. And at 6:40 AM the armored cars of the advance guard routed near Nowo-Rudnia a Russian squadron of cavalry. Cavalry appeared to be the only enemy so far encountered. The American fliers, Shrewsbury and Cooper, watched the movement of the column and periodically reported its progress to higher commanders.

East of Nowo-Rudnia the sandy road grew worse and materially slowed up the trucks. Several times the Packard trucks had to be pushed by man-power out of the deep sand or over broken bridges. The Fiat half-track vehicles had less difficulty and drew away from the Packards. The column became elongated and somewhat disorganized.

At 7:30 AM the advance guard, after a short engagement with Russian cavalry, took the village of Sokolow. Thereafter the column had little opposition until it approached Wilsk. At a village near Wilsk a Russian force caused the column to begin detrucking preparatory to an attack. But about this time a friendly plane dropped a message. After some delay in order to find someone who could translate English, the message was read. It advised that the Russians had withdrawn. The troops entrucked and pushed on. At 3:00 PM the motor column arrived before Wilsk.

The Russians held Wilsk with the 1st Regiment of the

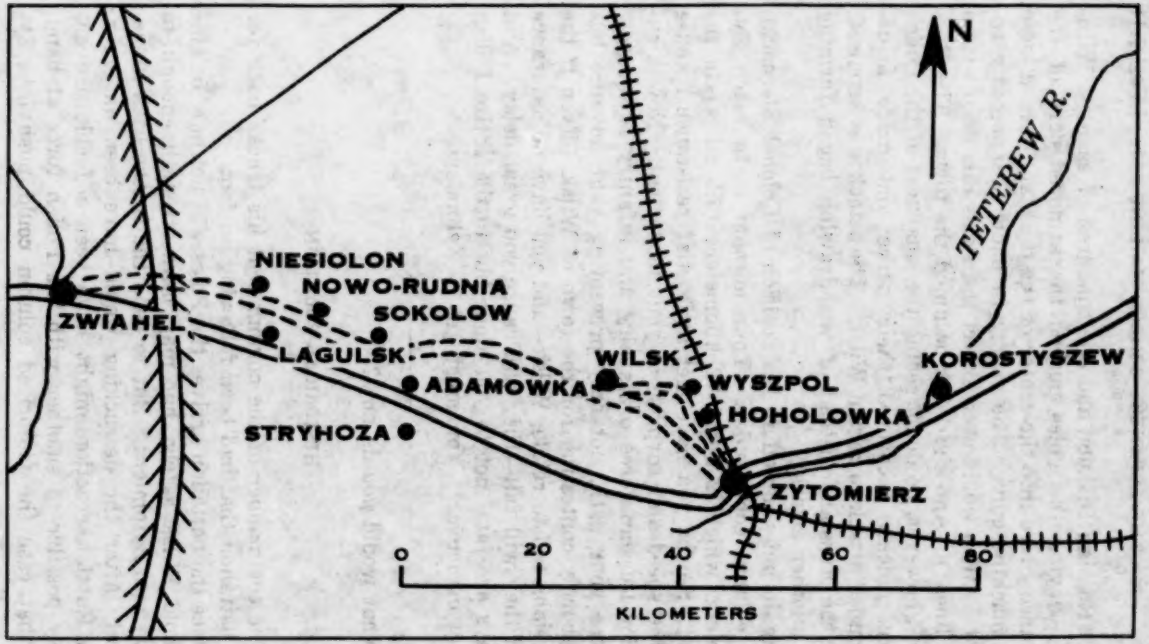

FIGURE 47.—The Zwiahel-Zytomierz area.

58th Russian Division and one squadron of cavalry. Without delaying the Poles pushed the armored cars of the advance guard into the center of the town and turned loose the machine guns. The enemy in panic beat a hasty retreat. (Who would ever expect the Poles this deep within the lines?) And the Poles occupied the town. The Russians, however, no doubt seeing the smallness of the Polish force, quickly recovered their nerve and made a determined attack to regain Wilsk. The attack was repulsed, but the Russians instead of withdrawing began forming for another attack.

Again put yourself in the position of Colonel Biernacki, the column commander. Your mission is to reach Zytomierz, which is about 12 kilometers (7.5 miles) to the west. So far you have met little stiff resistance because of the speed and surprise of your movement. Now a superior Russian force of cavalry and infantry is squarely across your path, not only preventing your advance but stubbornly contesting for the town of Wilsk. Even if the Russians fail to retake Wilsk—and you have no assurance that they will fail—they will cause you great delay. And delays are fatal not to you alone but to the entire Polish army maneuver. You must get to Zytomierz.

What would *you* do now?

HISTORICAL SOLUTION

The commander of the column sent his trucks back for the battalion that had been following on foot.

Once the battalion arrives the Poles will not only be able to hold Wilsk safely, but may have strength enough to drive into Zytomierz. But to send the trucks back immediately after the detrucking would have been an error. The Russian reaction might have been a feeble one entirely possible to smother with the Polish force at hand. In that case the motorized column could push into Zy-

tomierz before night. But as soon as the Russians, superior in numbers, displayed an intention of putting up a stubborn fight it was high time to get more troops. The trucks were the quickest means of getting them and the marching battalion of the regiment was the nearest available unit. (Is this the first use of the "hitch-hiking" of units now quite common in our army maneuvers?)

Again the Russians attacked Wilsk. The Polish force stubbornly held on, and while the fight was still raging the trucks returned with the trailing battalion. This was just before dark. At nightfall the fighting ceased, and the Russians took advantage of the darkness to withdraw toward Zytomierz, leaving the Poles in the possession of Wilsk. But the situation was still critical. The Polish objective was still Zytomierz. They must reach there sometime the following morning, but a Russian force larger than the Polish was blocking the way. At the time certainly the Polish commander must have realized that the startling tidings of his presence at Wilsk would spread. It is now known that the Russian 58th Division was informed of the fighting at Wilsk and that by night the news had reached the Russian 17th Cavalry Division on this front.

On the other hand the Polish supporting troops were far in the rear. They had progressed slowly and only by hard fighting had they been able to reach Adamowka and Stryhoza.

By surprise and speed the motor column had almost reached its objective but not quite. Now the surprise was gone. Russian headquarters knew the location, and probably the size, of the motorized force. It could be expected that Russian troops would be rushed to cover Zytomierz. Unquestionably the 58th Russian Division would move on Zytomierz during the night. Detachments of the 17th Cavalry Division could also be expected to converge on this town. Once these forces occupy the city and dig in, the motorized attack will surely fail; and perhaps the

whole motorized force will be lost, for it is already far within the Russian lines.

Once again put yourself in Colonel Biernacki's place. It is now dark.

What do you do *now*?

HISTORICAL SOLUTION

Colonel Biernacki decided to make a night attack on Zytomierz.

Since the enemy would be expecting him to advance along the Wilsk-Zytomierz road he decided to utilize his mobility to secure surprise. Therefore, he planned to swing his motorized column wide to the north via the Wyszpol-Hoholowka road and attack Zytomierz from the north while the Russians were expecting his advance from the west. Meanwhile, his other battalion on foot would advance straight east along the old road and attack as a feint, thus fixing Russian attention on the west until the main attack struck.

There is true audacity in this plan. Here is a unit well within the enemy lines. Yet it splits into two parts and attempts a distant night maneuver against a larger force —a force that before morning—depending on how rapidly the Russians converge on Zytomierz—may be vastly superior. For the Poles to wait until morning, however, may give the Russians just the time they need to concentrate on Zytomierz and actually overwhelm the Polish force at Wilsk.

At 12:00 midnight the movement began. One lone battalion advanced straight on Zytomierz; the other two, preceded by armored cars, swung off to the north on the Wyszpol-Hoholowka road. The whole night was spent in fighting and dispersing detachments of the 58th Division and the 17th Cavalry Division. These were doubt-

less converging on Zytomierz, and the Poles thus had an opportunity of defeating them in detail. At 8:00 AM Zytomierz was entered, and the fighting continued in the streets. The Polish armored cars engaged some Soviet tanks in several actions and finally damaged and captured them. (Is this skirmish the first brush between mechanized units?)

At 9:00 AM the Poles captured the bridge across the Teterew. It was not until 10:00 AM that other Polish forces arrived. By 11:00 AM the fighting in the streets came to an end, and the enemy, with heavy losses, retreated eastward, leaving in Polish hands 1,000 prisoners, 10 guns, and a considerable amount of heavy machine guns and war material. A pursuit of the 58th Russian Division was initiated at 3:00 PM. One regiment with a half battalion in Fiat half-track trucks, and a platoon of armored cars, composed the pursuing force. The entrucked troops swiftly advanced toward Korostyszew and attacked the Red rear guard there. It soon forced it out of the town, captured the bridge across the river, and proceeded to form a bridgehead.

To the south the cavalry had captured Koziatyn and the entire Soviet front was shaken. The first phase of the advance on Kieff was a success, thanks largely to the unique use of motorized infantry.

We can sum up this operation about as follows: In the course of 24 hours and in one great bound motors had conveyed infantry 50 miles within the enemy line and brought it to the place where the typical infantry characteristics could be used against a sensitive enemy point. This was done, over poor motor roads and in a poor motor country, by a hastily improvised force of a newly organized army of an agricultural people. As a fact all by itself, it commands attention and respect.

That, however, is not all. This might be one of those accidents of war. If so it would have but slight significance. Only when we consider this with other motor

actions can we ascertain its true significance. Later at Kowel a similar action of Polish motorized forces was highly successful. And when Marshal Pilsudski, in the final great battle of this war in front of Warsaw, threw his mass of maneuver against the Soviet left and destroyed it, we find motors again carrying infantry far out to the front of the maneuver mass.

Can we say that this use of motorized infantry shows a definite trend and indicates what may be expected in future open warfare? Who can tell? But as this is written the Italians in Ethiopia seem to be following the same trend. Several columns of motorized infantry preceded by a fan of light, fast tanks, and flanked by tank shields, are driving deep into the enemy lines aimed at critical points. It is the Polish method with more modern trimmings.

Unquestionably, if these Polish operations had been conducted by German units they would have received long since respectful attention and close study. However, the Polish-Russian war appears to many as but a conflict of disorganized masses, poorly led, hence not worthy of study. Be that as it may, we should remember that our own Civil War was once regarded with disdain by certain European authorities as being but a conflict of "armed mobs" led by amateur soldiers. Yet if European military students had given the Civil War more careful study, the World War might have been far more skillfully fought, for the Civil War indicated clearly the pattern of the World War.

Does Zytomierz indicate the pattern of future open warfare?

CHAPTER 10

Antiaircraft Small Problems

(Small Tactical Situations Illustrating Infantry School Teachings)

In Chapter 12, Volume XI, of *The Mailing List*, the tactical aspect of antiaircraft measures for infantry was discussed. To show their application in numerous situations that might occur in war in any small infantry unit is the purpose of the present chapter. Each of the situations given is simple and is accompanied by a solution, and where appropriate, a discussion.

In considering these brief situations the reader should remember above all the high speed of the aerial attack. The actual attack, and hence the period of active antiaircraft effort, is always a matter of seconds. But even such fleeting periods of time are still long enough for effective measures to be taken.

PROBLEM NO. 1

SITUATION.—An air guard who has previously had instruction in airplane identification is guarding a column on the march. He sees a formation of nine large planes of a type with which he is not familiar, approaching at an altitude of about 1500 yards.

REQUIREMENT.—What is his action?

SOLUTION.—The air guard does not sound the alarm. He watches the planes to see whether they come closer to the ground as if they were going to make an attack, or continue their flight at a high altitude. He continues to watch for their reappearance at a low altitude for some time after they pass out of sight. He also makes note of their appearance with a view to finding out later whether they were hostile or friendly planes of a new type.

DISCUSSION.—As far as the air guard knows, these planes may be either friendly or hostile. Their appearance is not that of a hostile attack, however; and they are beyond the range of infantry weapons. Consequently he does not sound the alarm. If they are hostile planes, they may at any time dive low to make an attack. Hence he watches them as long as they stay within sight, and continues to watch for their possible reappearance in a low altitude attack.

PROBLEM NO. 2

SITUATION.—It is raining. Clouds are low. An air guard of a bivouac hears a large number of planes approaching low. He cannot see them. He is not sure of their direction or what they are.

REQUIREMENT.—What does he do?

SOLUTION.—The air guard sounds the alarm at once.

DISCUSSION.—The noise of the approaching planes is probably that of a hostile attack formation. The attack may not be directed against the particular bivouac that the air guard is guarding, especially since the weather conditions may prevent the planes from seeing the ground. However, the fact that the air guard cannot see the planes neither indicates definitely that they cannot see the ground nor that the troops in the bivouac would not be able to see the planes, since the planes will in all probability come below the clouds when they actually attack.

PROBLEM NO. 3

SITUATION.—A battalion is ordered to march on foot with the utmost dispatch from one point to another. The march must be made by day, and there is danger of hostile air attack. There are two roads. One lies through open country and is nine miles long. The other has many turns, and passes through much wooded terrain. It is 11 miles long.

REQUIREMENT.—Which road does the battalion take and why?

SOLUTION.—The battalion takes the short road through through open country.

DISCUSSION.—The orders require the movement to be made with utmost dispatch. In the choice of route anti-aircraft considerations must therefore be disregarded.

PROBLEM NO. 4

SITUATION.—The ground is covered with snow. A unit has to march over dirt roads. Hostile observation aviation is active. Previous traffic over the roads has obliterated most of the snow in the road bed, but along the sides and beyond the right of way the snow is undisturbed.

REQUIREMENT.—What special instructions should be given regarding march formations, if any?

SOLUTION.—The units should march on the road itself, and should not take an extended formation to the sides of the road, even where the terrain permits, until an attack alarm is heard.

DISCUSSION.—The unit is less likely to be discovered by hostile air observers if it remains entirely on the road, against which the troops would make less contrast than against the snow to the sides of the road.

PROBLEM NO. 5

SITUATION.—An attack from the air has just passed over a column on the march. A platoon commander (rifle company) sees a sergeant directing his men to resume their places on the sides of the road in antiaircraft march formation.

REQUIREMENT.—The action of the platoon leader.

SOLUTION.—The platoon leader directs the sergeant to stop assembling his men and have them deploy again and remain deployed until it is reasonably certain that the hostile attack is not coming back over the column.

PROBLEM No. 6

SITUATION.—Several planes come over a marching column at an altitude of roughly a mile and began to drop bombs on the column. A rifle platoon commander sees most of his men begin to fire at the planes.

REQUIREMENT.—The action of the platoon commander.

SOLUTION.—The platoon commander immediately blows his whistle, and gives the signal: *Cease firing*, and *Down.*

DISCUSSION.—Planes a mile high are out of effective rifle range. Instead of firing, all men should take whatever cover is near-by, throw themselves prone, and remain so until the attack is over.

PROBLEM NO. 7

***SITUATION.*—A rifle platoon (leading element of a larger unit) is marching along a road in antiaircraft formation. It reaches a stretch of ground where for two miles there are thick woods on one side and open fields with no fences on the other. (A in Figure 48.)**

***REQUIREMENT.*—What formation does it take at this point?**

***SOLUTION.*—The platoon spreads out in an extended marching formation to the side of the road away from the woods.**

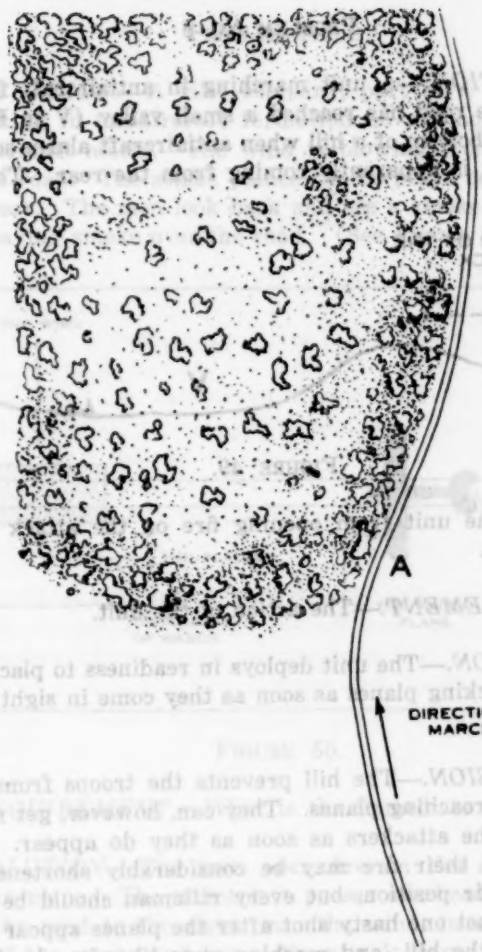

FIGURE 48.

PROBLEM NO. 8

SITUATION.—A unit marching in antiaircraft formation on the road has reached a small valley (V in Figure 49) at the bottom of a hill when antiaircraft alarm sounds. The attack is apparently coming from the rear. The hill

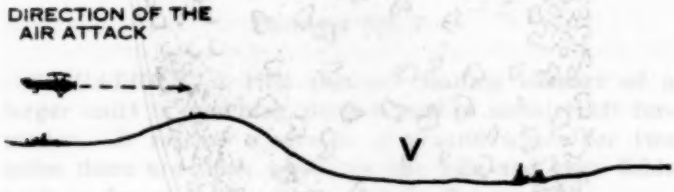

FIGURE 49.

prevents the unit from opening fire on the attack as it approaches.

REQUIREMENT.—The action of the unit.

SOLUTION.—The unit deploys in readiness to place fire on the attacking planes as soon as they come in sight over the hill.

DISCUSSION.—The hill prevents the troops from seeing the approaching planes. They can, however, get ready to fire at the attackers as soon as they do appear. The duration of their fire may be considerably shortened in view of their position, but every rifleman should be able to fire at least one hasty shot after the planes appear over the top of the hill; and machine guns likewise should be able to place a short burst on the planes.

PROBLEM NO. 9

SITUATION.—A rifle company, part of a larger unit marching in antiaircraft formation on a road, hears the antiaircraft alarm. The wind is blowing from the right of the road. The attack planes can be heard coming from the rear. The men look back and see a smoke plane coming, laying smoke over the road. (See Figure 50.)

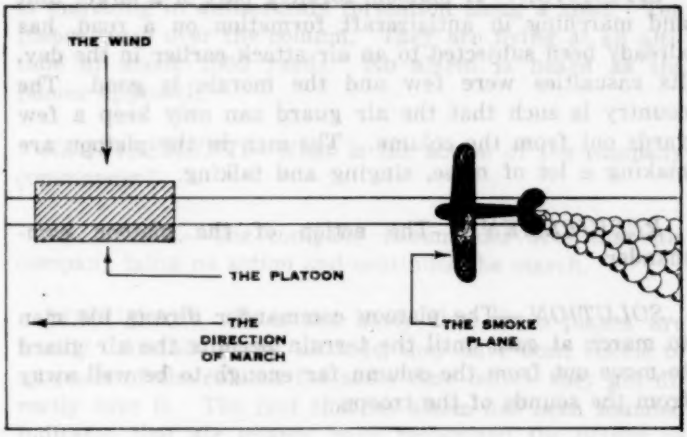

FIGURE 50.

REQUIREMENT.—What is the immediate action?

SOLUTION.—The men open fire on the approaching smoke plane. The moment it passes overhead they move off the road to the right, into the wind, in order to get out of the smoke and fire at the attack planes that can be expected to follow 10 or 15 seconds' flight in rear of the smoke plane. All leaders see that their men stop firing as soon as the smoke plane passes over, and then direct their movement into the wind. If the terrain prevents a movement off the road, the leaders get their men down on the ground as soon as the smoke plane passes by.

PROBLEM No. 10

SITUATION.—A platoon, forming part of a larger unit and marching in antiaircraft formation on a road, has already been subjected to an air attack earlier in the day. Its casualties were few and the morale is good. The country is such that the air guard can only keep a few yards out from the column. The men in the platoon are making a lot of noise, singing and talking.

REQUIREMENT.—The action of the platoon commander.

SOLUTION.—The platoon commander directs his men to march at ease until the terrain permits the air guard to move out from the column far enough to be well away from the sounds of the troops.

PROBLEM NO. 11

SITUATION.—A rifle company, part of a larger unit, is marching in antiaircraft formation along a road. Ten planes come over the column. They are flying at an altitude of about 1500 yards. No alarm is heard as the planes approach.

REQUIREMENT.—What is the action of the company commander?

SOLUTION.—The company commander sees that his company takes no action and continues the march.

DISCUSSION.—It is not likely that these planes are hostile. At 1500 yards' altitude, they have been visible to all parts of the column for some time before they get directly over it. The fact that no alarm has been sounded indicates that air guards have recognized the planes as friendly.

MAILING LIST——7.

PROBLEM NO. 12

SITUATION.—As a column on the march makes a regular hourly halt, an animal-drawn machine-gun platoon, marching in rear of a rifle company, finds itself in a small patch of dense woods. (See Figure 51.) The platoon leader can see a break in the woods about 200 yards down the road. It is about the same distance back to the point where the platoon entered the woods.

REQUIREMENT.—The action of the platoon commander.

SOLUTION.—The platoon leader directs the gun crews to place the guns ready for antiaircraft fire in positions in the road as shown in Figure 52.

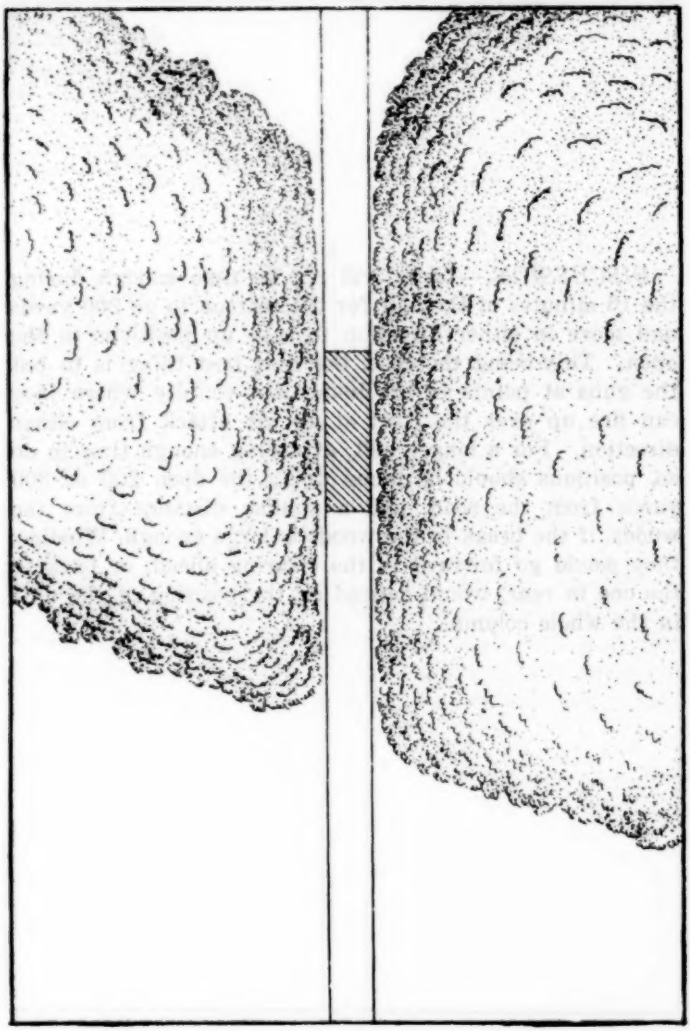

FIGURE 51.

DISCUSSION.—There will not be time enough during the 10 minutes of the halt for the platoon to go 200 yards and more in either direction to take up positions in the open. This being the case, the next best thing is to put the guns at points in the immediate vicinity where they can fire up over the road at an air attack from either direction. For a longer halt, affording enough time to do so, positions should be taken up in the open 200 or 300 yards from the road, and a similar distance from the woods, if the break in the woods is large enough. Whether they would go forward to the clearing ahead, or back to the one in rear, would depend on the position of the unit in the whole column.

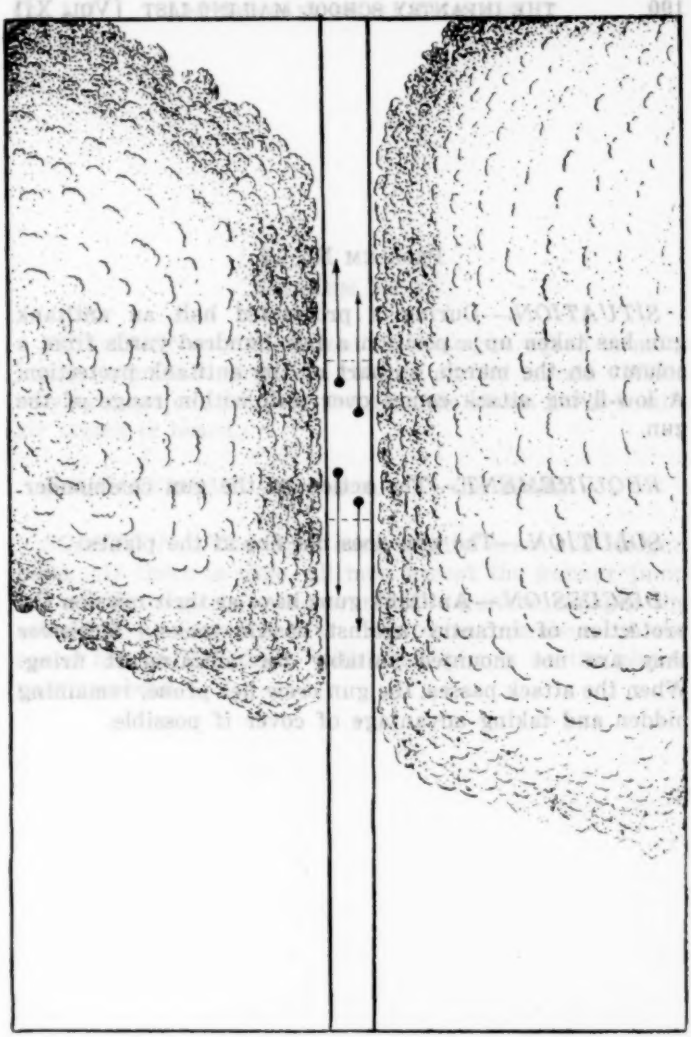

FIGURE 52.

PROBLEM No. 13

SITUATION.—During a protracted halt an antitank gun has taken up a position a few hundred yards from a column on the march, as part of the antitank protection. A low-flying attack comes over well within range of the gun.

REQUIREMENT.—The action of the gun commander.

SOLUTION.—The gun does not fire at the planes.

DISCUSSION.—Antitank guns have as their mission the protection of infantry against hostile tanks. Moreover they are not mounted suitably for antiaircraft firing. When the attack passes, the gun crew lies prone, remaining hidden and taking advantage of cover if possible.

PROBLEM No. 14

SITUATION.—A motorized machine-gun squad is moving by bounds to protect a column on the march. While moving from one point to the next the alarm for a hostile air attack is heard.

REQUIREMENT.—The action of the squad.

SOLUTION.—The truck carrying the crew and its gun halts. If there is time, all men except the gunner jump out of the truck to seek cover. The gunner engages the attacking planes with fire. The other members of the squad fire at the planes with their pistols as the planes pass overhead.

PROBLEM NO. 15

SITUATION.—Planes attack a truck column. In a truck carrying two squads of a rifle company there is not time for the men to get out of the truck.

REQUIREMENT.—What men open fire? What do the other men do?

SOLUTION.—The automatic riflemen at the end or side of the truck toward the attack opens fire on the approaching planes; riflemen riding at that same end or side of the truck also open fire. The other men in the truck crouch as low as possible in the body of the truck.

PROBLEM No. 16

SITUATION.—An air attack strikes a company. The company commander sees nothing requiring his action in the immediate preparation of the troops near him.

REQUIREMENT.—Does he fire his pistol at the hostile planes as they pass overhead?

SOLUTION.—Yes; he fires his pistol.* Every armed officer and enlisted man should fire at the attacking planes with his individual weapon, unless he is engaged in firing a machine gun, or in directing the firing of others.

* Remember what happened to Goliath.

PROBLEM NO. 17

SITUATION.—Six squads of a rifle company are riding in a freight car in a troop train. The platoon sergeant has been instructed that his men will fire at any air attack. The car has one wide door on each side.

REQUIREMENT.—How should he assign weapons and men to the doors of the car to fire at attacking airplanes?

SOLUTION.—The sergeant directs two automatic riflemen to remain near each door ready to fire at attacking planes.

PROBLEM No. 18

SITUATION.—**Ten squads of a rifle company are riding in a day coach in a troop train. The lieutenant whose men occupy the car, knows that an air attack is likely to occur. The car has 12 windows on each side.**

REQUIREMENT.—**How can he best assign weapons and men to the windows of the car for firing in case of an air attack?**

SOLUTION.—**The officer in charge of the car places five automatic riflemen in outside seats distributed along each side of the car. He assigns a rifleman to each of the other windows.**

PROBLEM NO. 19

SITUATION.—A rifle platoon has just gone through a hostile air attack. The platoon commander saw, during the attack, that less than half of his men failed to fire at the attacking planes. The platoon has been reassembled; casualties have been cared for.

REQUIREMENT.—What does the platoon commander say to his platoon regarding future firing?

SOLUTION.—The platoon commander emphasizes three facts:*

1. The more ground fire there is, the more planes are brought down.

2. The more hostile planes brought down, the fewer planes the enemy will have to attack with.

3. There is no chance of running from an air attack. It comes too fast. Fire is the only correct measure.

---

* The real solution is unprintable.

PROBLEM NO. 20

FIRST SITUATION.—A rifle unit is in bivouac at night in a sparsely wooded area. The antiaircraft alarm is heard. Many planes are heard approaching.

FIRST REQUIREMENT.—The action of squad leaders.

SOLUTION.—Squad leaders see to it that their men stay in their foxholes and do not attempt to fire at random at targets which they cannot see.

DISCUSSION.—Here the squad leader, sleeping in his foxhole is awakened like his men by the sudden alarm. The conditions favor a high pitch of excitement, and even panic. Every leader's first thought should be to keep his men under control and cover.

SECOND SITUATION.—The planes come over the bivouac and can be heard in all directions above the general area. Flares appear above the bivouac of the unit, and rapidly appear over adjacent areas, also. No planes can be seen but many can be heard, some of them circling directly over the bivouac, apparently just above the flares.

SECOND REQUIREMENT.—Is any positive antiaircraft measure taken by troops?

SOLUTION.—As soon as flares appear, all men make ready to fire at any hostile plane they may see.

DISCUSSION.—*a.* Movements by men on the ground are not likely to be seen, or if seen, to betray anything to

the occupants of enemy planes that they do not already know. The behavior of the hostile planes indicates that they are making a planned attack on a known bivouac area. The flares are being dropped, not to disclose the minute details of the area, such as the actual positions of small troop units, but to enable the whole attack to be made accurately upon the most likely spots, such as wooded areas along streams and roads.

b. Moreover, a single plane may be able to drop a flare, and circling well above it, keep entirely out of sight. But when numerous flares are dropped, as in this situation, it is difficult at best for a number of planes to stay entirely out of sight. The enemy, in fact, may choose to attack underneath his flares rather than above them; for that way his assault is more accurately placed and hence more effective.

c. Therefore, all men should prepare to fire, as soon as flares appear, at every hostile plane they see.

THIRD SITUATION.—As the flares settle toward the ground, a rifle company section leader plainly sees three planes coming toward his part of the bivouac, well within rifle range.

THIRD REQUIREMENT.—What is his action?

SOLUTION.—He opens fire on the planes.

DISCUSSION.—There is, very probably, so much noise in the air that his men will not hear him if he tries to indicate a target. But if he opens fire, those near him, at least, will follow suit.

PROBLEM No. 21

SITUATION.—A hostile airplane crashes in a company bivouac and bursts into flames.

REQUIREMENT.—The action of the company commander.

SOLUTION.—The company commander takes immediate steps to keep his men a safe distance away from the plane—at least 100 yards. The plane may still have bombs in it that are liable to detonate from the heat.

PROBLEM No. 22

SITUATION.—The cooks in bivouac are preparing a meal. An attack comes over.

REQUIREMENT.—What is their action?

SOLUTION.—They seize their weapons, which are at all times kept near-by, and open fire on the attacking planes.*

* An air attack passes so fast the slum won't have time to burn.

PROBLEM NO. 23

SITUATION.—A rifle platoon is marching in platoon column as part of a larger unit across country when the antiaircraft alarm sounds. At that moment the platoon is near a small clump of trees. Attack planes can be seen coming directly toward the platoon.

REQUIREMENT.—What is the action of the platoon?

SOLUTION.—The platoon quickly deploys out away from the trees so that it will have as wide an aerial field of fire as possible, and then opens fire on the planes as soon as they appear within sight and range.

DISCUSSION.—There is nothing to be gained if the platoon takes cover in the woods. A single platoon is not likely to be the object of an attack or of particular interest to any element of the attack. Moreover, a small clump of trees affords little protection from the possible effects of the attack. In marching across country, a unit offers such a dispersed target to a hostile air attack that many units will not be touched by it unless it is a gas attack over a broad area. Hence many units will be free to fire at the attacking planes while not in the path of the attack. Maximum antiaircraft fire is, under the circumstances, of primary importance.

PROBLEM No. 24

SITUATION.—A rifle platoon in the main battle position of a defense area is heavily engaged in repulsing a hostile ground attack. The enemy has not succeeded in penetrating the position but is bending every effort to do so. Hostile attack planes are heard above the other noise of battle, and seen coming from over the enemy's troops.

REQUIREMENT.—The action of the platoon.

SOLUTION.—The individual members of the platoon turn their fire against the approaching planes and continue to fire at them as long as they are within range.

DISCUSSION.—Attacking planes are within range for a maximum of only 20 seconds. The importance of turning every possible weapon of infantry against them to destroy them outweighs that of continuing fire against ground enemies. The period of antiaircraft fire will always be so brief that it should make small difference in the ground battle.

PROBLEM NO. 25

SITUATION.—A motor patrol, consisting of three cars, is reconnoitering. The cars are separated by about 200 yards and are moving on a road at high speed. A plane is heard flying low to the ground. The plane dives at the leading car.

REQUIREMENT.—The action of the occupants of the two rear cars.

SOLUTION.—The two rear cars halt. If there is time, the occupants get out and fire at the plane.

DISCUSSION.—It is not likely that the rear cars can halt soon enough for the occupants to get out and fire. But traveling fast, as they are, there is considerable danger that the cars will be wrecked if their drivers are struck by the fire of the plane. Hence brakes should be applied at once.

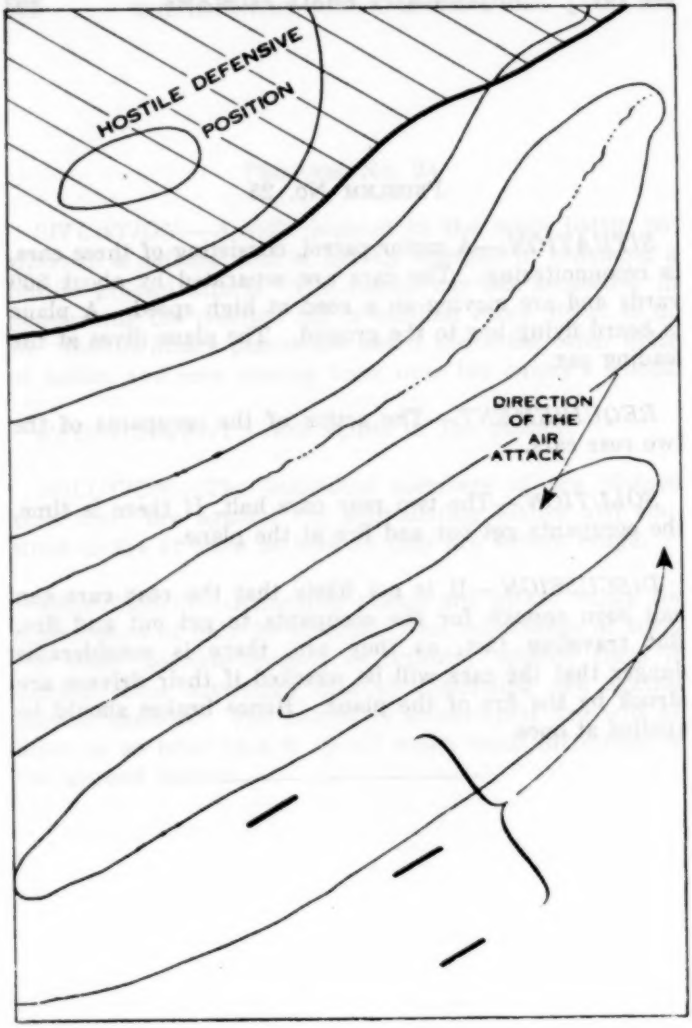

FIGURE 53.

PROBLEM NO. 26

SITUATION.—An infantry rifle section is attempting to work around the flank of a hostile position during an attack. It is making use of all possible cover and has not yet been observed by the enemy ground units. At present the section is deployed roughly in a line of squad columns, and is defiladed from the enemy by a low rise in the ground. A hostile element of three attack planes approaches attacking this section and other near-by units. (See Figure 53.)

REQUIREMENT.—The action of the section.

SOLUTION.—The men of the section all fire at the attacking planes as long as they are within range.

DISCUSSION.—If the section were not defiladed from the hostile ground position it is attempting to outflank, it would be better not to fire. But as things are, the attempt will not be given away, since the noise of the attack and other antiaircraft fire will drown out the sound of firing made by a single section.

CHAPTER 11

Route Information For Motor Vehicle Movements

(AN INFANTRY SCHOOL STUDY)

(This chapter is an original study containing only suggested methods, which are presented to stimulate thought and discussion.—EDITOR.)

The injection of motor vehicles wholesale into the art of war increases, it is self-evident, the mobility of the units motorized, whatever their size. But the realization of this mobility depends not alone upon the mere fact that vehicles are entered upon tables of organization as items of issue. Nor is it only a matter of training; for in the most perfectly trained unit imaginable on wheels mobility is still contingent on one further and vital element. That element is route information.

A potential average movement rate of 20 miles an hour or more, and a potential daily travel of 150 miles or farther, mean little unless there is complete information of the intended route at hand. Even in time of peace, and in a country so meshed with a net of roads as our own, we must hesitate to move blindly. At the very least we get road maps from the nearest filling station and note what highway route numbers must be followed and what detours there may be. And for a group motor vehicle movement of any size, much other information is desirable, if the movement is to run smoothly. With this the case in time of peace, how much more cautiously, then, it will be neces-

sary to proceed in time of war, and how much more thorough the knowledge of the country to be traversed must be.

Route information, moreover, is of great tactical and strategical value. It does not simply tell us where our own vehicles go, and how rapidly they can move along the different sections of a route. It informs us, too, what the possibilities, if not the probabilities, of hostile movement are through the same areas.

The necessity for complete and timely route information during active operations is even more apparent when we consider what motorization means from the broad viewpoint. A single corps of three motorized infantry divisions would contain more than 10,000 vehicles. If such numbers of motors are to move anywhere without confusion; if each individual unit is to advance in its own zone of movement; indeed, if the full advantage of movement by motor vehicles is to be even remotely approached, there can be no let up in the accumulation of route information from every possible source.

There must be too, of course, a systematic plan for the use of available routes. This matter of traffic regulation (and well nigh staggering it is) is closely tied in to that of securing route information. Obtaining knowledge of routes, however, comes first, and forms the basis for movement schedules and traffic regulation.

(Several aspects of military traffic are discussed in the next chapter. In this chapter, then, we confine our discussion to route information and the ways in which it can be obtained.)

We may well consider first how detailed our information of routes must be. Will a careful check of existing roads and their condition and capacity suffice, or must we require still more data? To this question there is only one answer. There can never be too much specific detail.

Information regarding primary and secondary highways alone is far from enough. Every unimproved road and track must be included. And beyond that, especially

where the road net is sparse, there must be as complete information of possible cross-country routes as can be obtained. For not only in the forward areas will it be necessary to move across country; at any time hostile aviation may destroy or block main routes at points far out from his forces wherever he believes such action may seriously hinder the movement of our troops, without hindering his own too much.

Route information, in fact, should be so complete that the commander of a motorized column, at any time he finds his road blocked, can immediately take a secondary route. Let us say, for example, that a regimental commander receives word that the route his column is following has been destroyed at a point several miles ahead. At that moment, the commander's information of possible alternate routes should be so complete that he can immediately decide whether he must reverse column, continue on to take an alternate side route, or cut across country.

This may seem a big order, and no doubt it is. But it is an order that must be filled if we are to realize to the full the potential mobility of motorization. In the remainder of this chapter we shall consider how the information that we shall inevitably need could be obtained.

We shall consider the matter, for the most part from the viewpoint of infantry officers engaged in a war within the continental limits of the United States. For here we have a great variety of terrain and road nets. Few countries of the world, however, do not have a comparable variety of both in the present day. Even in a supposedly backward country such as China, it has been found so profitable to operate bus lines that in the past few years thousands of miles of roads have been built by private enterprise from private funds.

The main sources of route information are, first, maps and, second, information gained by reconnaissance, air and ground. When the first are not to be had, we must, of course, rely on the second, building up a system of

maps from the data that reconnaissance brings in. But except in uncivilized areas of the world, we may expect that maps of varying degrees of accuracy will be available.

We know, for one thing, that up-to-date automobile road maps are continually kept up and readily available in all civilized countries. These, at the outbreak of hostilities, would give better information of existing primary and secondary roads than all but the latest topographical maps. New motor roads are laid yearly but new topographical surveys seldom occur more often than once a decade.

But road maps give no information whatever as to minor roads, tracks, and trails, and the possibility of moving across country. Thus the latest road and topographical maps would both be needed.

Collecting and disseminating route information at the beginning of a war is a function of the Corps of Engineers. From then on, whatever movements of troops are made, the most complete existing knowledge of routes must be constantly sent down from higher headquarters to lower. And troops of all arms must assist in collecting the data on which this knowledge is based.

As armies advance or retire, fresh supplemental route information must flow in continuously from reconnaissance agents of the air and ground. Air observation will be of chief value in obtaining route information by making rapid checks of main and secondary routes just prior to a motorized movement, and in reporting damage and destruction accomplished by hostile agents. It will seldom be possible, however, to obtain detailed cross-country route information by air means, since the ground itself must be examined to determine practicability of passage. On the ground, every reconnaissance agency from the most distant motorized and mechanized elements inward to the close reconnaissance elements of small units must continually augment the available information.

Distant motorized reconnaissance detachments with a cavalry mission, composed of cavalry augmented by motor-

ized infantry as necessary, operate more than a day's motorized march out from a main force—even as far out as 225 miles when that is desirable. (Until we have ample armored cavalry forces available it seems probable that by far the greater part of the distant cavalry reconnaissance mission would have to be performed by motorized infantry supplementing what cavalry was on hand.) Horse cavalry reconnaissance does not go out so far but to a maximum distance of 60-75 miles. Close-in reconnaissance extends out from a moving force toward the horse cavalry elements; and according to present Command and General Staff School teachings, brigade or division motorized reconnaissance detachments of the type described below may reconnoiter out farther than the horse cavalry in order to conserve that element for later use. All three of these agencies, however, must not only look for signs of hostile activity but check existing knowledge of routes and add to that knowledge. Now let us consider, in turn, the potentialities of all types of infantry reconnaissance elements for obtaining route information, taking up distant reconnaissance first.

Assuming that the enemy is fully as capable of rapid movement by motor vehicle as we are, and that our air elements are doing their best to detect the enemy's major troop movments, we must nevertheless supplement the work of air observers by establishing an impenetrable ring of distant ground reconnaissance. The scope of the work to be done by distant reconnaissance elements, and one possible way of doing it, was covered in Chapter 4 of Volume XI, The Infantry School Mailing List. Recent teachings at the Command and General Staff School cover in detail the formation and composition of one type of motorized reconnaissance detachments, which might well be suitable for distant reconnoitering when such infantry units must be used to supplement available armored cavalry.

Motorized reconnaissance detachments, according to the Command and General Staff School, are not permanent units; they are formed when necessary. A reinforced brigade may form one of them and a division two. Thus, a corps of three divisions could have six, and an army of three corps, 18, if that many were needed. It seems probable, however, that the maximum number of detachments sent out by a large force would be the total of those from advance, flank, and rear divisions only, in the ordinary case in which all-around protection is needed.

We can arrive at a clearer view of the number of these detachments required if we examine the diagram in Figure 54. At a maximum radius of 225 miles, the perimeter of reconnaissance is roughly 1400 miles. Part of this perimeter, of course, is likely to be protected to some extent by terrain barriers but all of it must at least be watched. Evenly divided among 18 reconnaissance detachments, each would have over 75 miles to cover—a tremendous task for a few hundred men in a few score motor vehicles. (Part of this work would, of course, be performed by whatever armored-car and similar cavalry units were available, since the whole job is purely a cavalry mission. The methods suggested and described herein, however, are appropriate to any distant ground reconnaissance agency.)

Each infantry reconnaissance detachment, commanded by a lieutenant colonel, consists of one rifle company, one machine-gun company, and attached artillery, engineers, and communications troops. All elements, of course, are motorized. The rifle company is taken from the advance-guard and the machine-gun company from the reserve of the brigade or division from which it comes. The commander comes from the reserve. Thus a reconnaissance detachment is a compact and highly mobile unit of several hundred men, capable not only of obtaining information of the direction of the hostile advance but also of considerable resistance and other delaying activity.

Now whether these detachments move out to protect a

large advancing force or whether they form a cordon of information and delay, giving way as slowly as they can before an enemy, hindering his mobile units by blocks, demolitions, and fighting, they must collect route infor-

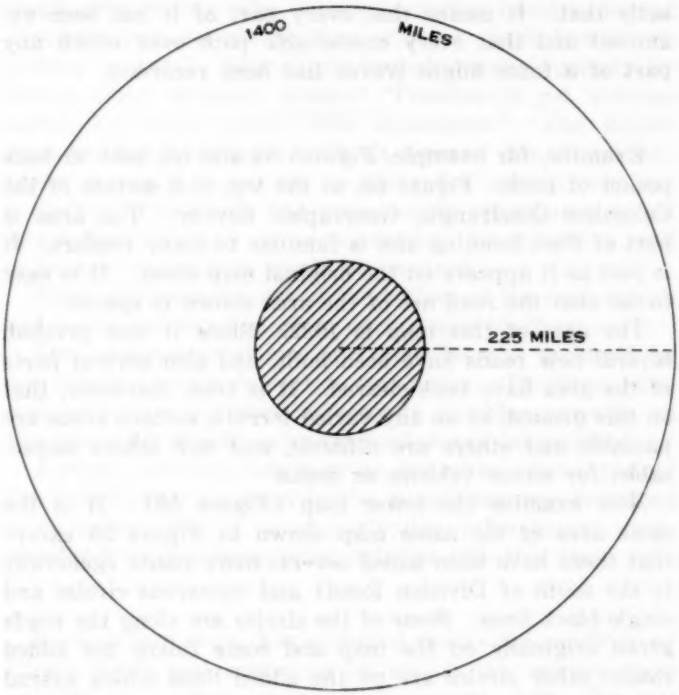

FIGURE 54.

mation for their own benefit and for that of the whole force. There must be a member of each reconnaissance detachment staff specifically charged with the task of obtaining this data. Every patrolling vehicle, as it passes over new roads and investigates new areas, must have one man of the crew who observes and notes the possibilities for motorized and mechanized movement.

Noting such information should, in fact, become habitual and collecting it should be a continuous process. When an area is occupied for some time, and it becomes thoroughly known, the only reports necessary would be those of changes. But "thoroughly known" means exactly that. It means that every part of it has been examined and that every conceivable path over which any part of a force might travel, has been recorded.

Examine, for example, Figures 55 and 56, both in back pocket of book. Figure 55, at the top, is a section of the Columbus Quadrangle, Geographic Survey. The area is part of Fort Benning and is familiar to many readers. It is just as it appears on the original map sheet. It is easy to see that the road net of the area shown is sparse.

The date of this map is 1932. Since it was printed, several new roads have been built, and also several parts of the area have been cleared. It is true, moreover, that on this ground, as on any varied terrain, certain areas are passable and others are difficult, and still others impassable, for motor vehicles or tanks.

Now examine the lower map (Figure 56). It is the same area of the same map shown in Figure 55 except that there have been added several more roads (generally to the south of Division Road) and numerous circles and single black lines. Some of the circles are along the roads given originally on the map and some follow the added roads; other circles are on the added lines which extend out from the roads, some for a short distance and some for a mile or more, and others somewhat parallel to the roads. There are also a few areas shaded with single cross-hatching and some with double, and some of the double cross-hatching has solid dots near it. These lines and shaded areas, it will be observed, are not found on the whole area shown.

The added roads shown in Figure 56 were sketched in from an aerial photograph in a few minutes' time, not accurately, but roughly. Without an aerial photograph,

they could have been sketched in from the ground.

The other marks on the map were added during an actual route reconnaissance.

The circles along the roads mean, "OK, vehicles can travel here and the road is the type of road shown." The single lines with circles, which lie across country, mean: "Vehicles can get across here without much trouble by picking a way." The single cross-hatching (principally shown along streams) means: "Possible to get vehicles across by using simple field expedients." The double cross-hatching indicates difficult ground for motor vehicles or, on streams, the necessity for ponton or other bridging. The black dots near double cross-hatching indicate that the areas are so impassable that extensive road or bridge construction would be required.

There are several notes at the bottom of the map, which add to the information given on the map itself.

The information shown in Figure 56 was gathered by one officer (with a driver) in two hours. The time, however, is not so important a factor to consider, perhaps, as the ease with which such information can be acquired.

A more elaborate code may be desirable. But certainly the information obtained in the simple manner described is valuable. And it is of particular value to any commander who may later bring vehicles into this area.

Route information thus gathered checks the condition of known roads and routes as shown on the original map brought up to date by aerial photograph data. To this is added all further knowledge obtained on the ground, including a considerable amount of cross-country route information.

This information is collected, moreover, by all patrolling elements in the course of carrying out their other duties. As patrolling elements return to a central point, the route information they have collected is coordinated, checked, and placed upon a single map, by the route information personnel at reconnaissance detachment headquarters—

this, of course, in addition to reports of enemy indications and activities, and other pertinent news.

At the headquarters of the division, route information from all reconnaissance detachments and other patrolling elements is consolidated and distributed periodically to all subordinate units. Here again it is best to transmit the route information in map form with enough copies so that none need be made by subordinate units. Copies should also be sent to the next higher unit.

It is also particularly desirable to send forward copies of consolidated route information maps to all agencies engaged in collecting such information. These may be accompanied by orders to get further information desired of any area.

Independently of these requests, of course, the route information officer with reconnaissance detachment headquarters seeks continually to fill out information gaps. He recommends, if necessary, to the commander that special visits be made to areas about which little or no route information exists.

In addition, patrolling and reconnaissance elements visiting areas that have already been reported upon once, extend the knowledge of those areas. Special reports should be obtained regarding bridges and roads in poor condition by engineer personnel with each reconnaissance detachment; and where it is pertinent, possible stream-crossing points should also be reconnoitered and reported on.

This later information, like the first obtained, passes back through the same channels of collection, coordination, and final dissemination. The process is continuous. And the checking of previously collected information must be continuous also. Neither can be too detailed.

At the same time, collecting route information does not take precedence over more important missions. A motor patrol, ordered, for example, to reconnoiter a given area hastily for signs of the enemy, would not delay its main mission to pick up route information. But it would at

least report on the roads it covered, and give what additional information there was time to note.

In a manner similar to that in which active information-seeking patrols and other agencies pick up route information at the same time they are collecting other data, the two types of information may well be handled in conjunction at headquarters of coordinating units. Route information not only tells us where we can go if we need to, but also where the enemy can go if he wants to, unless we obstruct his motorized elements. Therefore it must be closely studied in the light of intelligence.

For this reason, if for no other, the personnel that handles route information at every headquarters must work under or with the intelligence officer. Whether the information comes from engineers, infantry, artillery, or any other troops originally, it must pass through intelligence hands, or must be made known to them fully. Here, if ever, is information that is of interest to all.

Nor is it safe to assume as regards dissemination of this information that certain parts of it are only of interest to certain units. They should all get it all. Certain items may be included for the benefit of particular troops; for example, the data on stumps given at the bottom of Figure 56 is of special interest to combat cars or other cross-country fighting vehicles, and was noted for that reason. But this particular knowledge, important, certainly, to all infantry units, is likewise valuable to such arms as mechanized cavalry units and artillery. For example, artillery emplaced in or near an area thick with tree stumps need have much less fear of a tank attack over such an area. Likewise artillery used for antitank missions can consider such an area as an effective barrier against hostile tanks. Other units, too, may be interested in any area covered by the reconnaissance. Therefore, all information received should be coordinated and condensed in a single report, and sent out to all units.

This advance collection and dissemination of route data is not all that must be done to insure taking the maximum advantage of mobility. It is an infantry axiom that commanders must not place implicit trust in other agencies for the security of their own forces. A brigade commander dare not think, for example, "Well, the distant motorized reconnaissance is out ahead of me. I don't need to worry much about my close-in reconnaissance and security." Neither can a commander afford to rely exclusively on the advance route information furnished to him by distant reconnaissance agencies or from higher headquarters.

Instead, as soon as he knows that he must advance his motor column in a given direction, he must take two steps to insure its uninterrupted advance. He sends out a small reconnaissance detail a day or more in advance, provided of course that he receives orders in time to do so. (He may also make use of his own motorized reconnaissance detachment unless this detachment has already been sent out to augment distant cavalry reconnaissance.) And as the motor movement begins, he sends out traffic personnel to keep several miles ahead of the column as a final insurance against needless delays.

The advance reconnaissance detail operates under the column reconnaissance officer. This officer, as soon as orders for a movement are received, studies the data available regarding the route and then proceeds to move over the route and any alternate routes there may be. He and his assistants check the known route information and send back whatever further information of importance they discover. It may be desirable to send out more than one such group from a given column, when time presses, and there are one or more alternate routes to be covered.

One important task of such advance route details is to prepare detour data, so that the commander of the motor column is kept constantly informed of possible detours from any point on the route. As the column advances,

several things may make a detour necessary: roads blocked or bridges destroyed by hostile bombing or shell fire; similar causes of delay due to weather changes; inaccurate advance route information from higher authority; and changes of plan requiring a change in route. Whatever the cause, advance route details should have complete enough knowledge of the practicabilities of detour to enable the column commander to take a new route at any time he has to, and this with the least delay.

The route reconnaissance officer and his assistants may also have any of the following duties:

(1) To select tentatively, before going on reconnaissance, refueling points, messing points, and camps or bivouacs.

(2) To visit and check the suitability of these points.

(3) To make contact with civil or military authorities in the area through which the column is to pass.

(4) To check dimensions or capacities of bridges, viaducts, and underpasses.

It would ordinarily be desirable also for supply personnel to form a separate advance detail in order to leave the route reconnaissance personnel free for their main task. The latter should also be kept separate from patrols whose chief duty is to reconnoiter for signs of the enemy. A route reconnaissance detail has too much to do to perform adequately other reconnaissance missions, although it need not be blind to hostile activities or indications.

As necessary, information is sent back to the column commander.

Traffic details that immediately precede a moving motor column—by a few miles—also check route information. These consist of several men on motorcycles or in one or more cross-country cars or passenger cars. Even trucks can be used.

Advance traffic personnel cooperates with civil and military police in areas through which a motor column is to pass. They get in touch with the traffic police in each populous area, advise them of the approach of the column,

and, during its passage, may assist them in any feasible way. (These and other traffic matters are discussed in the next chapter.)

But in addition to purely traffic duties, advance traffic personnel does other important work to smooth the way of a column. It forms, in fact, the source of latest route information that the column commander has. It is his close-in route reconnaissance.

He depends primarily for route information upon reports from higher authority and upon his advance reconnaissance details working a day or more ahead of the column. The advance traffic detail, however, is his insurance against delay due to changes that may have occurred within a few hours. such as destruction of roads by hostile bombing.

The work of advance traffic personnel is particularly important to a commander when, for any reason, his route information is incomplete or lacking. Under these circumstances he may have to select his route from a map with little other knowledge of what the terrain actually is like. The traffic detail precedes the column and includes at least one truck carrying a pioneer detachment and equipment so that minor obstacles can be reduced. Where the route leads across country the detail selects the best way to go, marks the route, and if necessary, warns the column of bad stretches.

Here, again, all route information obtained by the advance traffic detail and the column itself should be noted and sent back to higher headquarters.

Once a unit enters an area, the division engineer becomes the main agency responsible for marking routes and, of course, for repairing them, as well as for coordinating new route information. All separate columns, however, and their advance traffic details continue to check, and add to, known route information.

And when an area is occupied for any length of time, there can be no excuse for incompleteness of route data.

Every yard of it, so to speak, must be investigated in order to record passable routes, and this knowledge, as always, coordinated and sent out to all units that may conceivably need it.

This, in sum, is a general outline of practicable methods of gaining, recording, coordinating, and disseminating the information that commanders of motorized and mechanized units must have if they are to make full use of the mobility inherent in mechanical transportation. At maneuvers during 1935, the progress of motorized units was often no faster than that of foot troops. The same thing will undoubtedly be true in many situations in war. But only when we have studied the handling of motorized columns exhaustively, and done everything in our power to turn into account their tremendous potential mobility —only then can we know the whole contribution that motor vehicles can make to warfare.

Even if it should prove true that on and near the field of battle motors do not increase greatly our troop mobility, at least we shall arrive sooner at the slow-speed area through advance knowledge of routes. And when contact is imminent, or has already been gained, the less a motorized column has to fumble its way, the better, certainly, it can move and, many a time, take advantage of its speed.

This, however, is only one aspect of the problem, although an important one. Another fully as vital is traffic, which is discussed in the next chapter.

CHAPTER 12

Road Capacities In Military Highway Traffic

(AN INFANTRY SCHOOL STUDY)

(This chapter is an original study presenting new data and containing suggested methods, which are here given to stimulate thought and discussion.—EDITOR.)

The application of traffic control in war has long since been recognized as a matter of vital importance whether it involved foot troops, mounted troops, animal-drawn units, or motor vehicles. The terrific traffic jams that occurred in France were minimized only when practicable traffic regulation was put into effect. This, however, was a problem comparable for the most part to that of traffic control in a city, especially at a time when the city is full of visitors from other places. The troop movements of the World War involved highway traffic also, as well as the handling of concentrated traffic in small areas, but by no means highway traffic as we now must face it. At that time, too, the motor vehicle elements of highway traffic moved at slow speeds and largely as controlled convoys. The restriction of roads for specific types of traffic and the adoption of a one-way system in crowded forward areas went far toward solving the difficulties.

But now we have great numbers of fast-moving vehicles to consider. For any army that advances in tomorrow's war will have large motorized and mechanized units with such high potential road speeds that we must think of their movements in terms of scores or even hun-

dreds of miles where before, except for special troop-carrying motor transport convoys, movement rates and distances were in general those of foot and mounted units.

We must consider, too, the advantages and disadvantages of long motor movements compared to those by rail. And where railroads are inadequate we must study the substitution of the automobile for the train. In other words we must think in terms of the civilization we live in, a civilization in which movement by highway has steadily encroached upon rail transport during the past decade. Thus we find that motorization and mechanization lead us squarely to new problems of highway traffic without diminishing in the least the importance of traffic control in more crowded areas.

In this chapter we shall consider road capacity with its complementary aspects of running speeds, road density, and road time. Much of the traffic data used herein is taken from a study made in 1931 by a committee of the American Road Builders Association, consisting of the chairman, Mr. M. O. Eldridge, Assistant Director of Traffic, Washington, D. C., six traffic engineers from cities in different parts of the country, one member of the Erskine Bureau of Traffic Research of Harvard University, one member of the U. S. Bureau of Standards, one State commissioner of motor vehicles, one traffic court magistrate, and six other officials or members of automobile clubs and other interested organizations. This report appeared in Bulletin No. 23 of the A.R.B. Association and included among other data the results of a study of the traffic capacity of the Holland Tunnel connecting New Jersey and New York. How the findings of this comprehensive report could be applied to military motor movements is the general subject herein discussed. This chapter does not cover road rules for convoy and other movements, except when these are pertinent to the main subject, nor does it touch, except generally, upon the duties of advance traffic details. A future article will treat the general subject, Motor Vehicle Movements.

RUNNING SPEEDS

If we are to move great motor columns or groups of columns from one place to another we shall have to know what traffic our roads will bear. When troop movements are calculated at 2½ miles an hour, a road is a road, and unless it is in terrible condition, knee deep in mud or pitted with shell holes, there is at least a fair chance that the troops will make their march and arrive where they are going in the calculated time. We may even reduce our estimate of the marching rate to 2 or 1½ miles an hour, or less, as we do for night and cross-country marches.

Motor movements, on the other hand, conceivably embrace a far wider bracket of speeds, all the way from speeds as slow as those of foot troops up to the highest practicable running speeds for the average driver, say 40 or 45 miles an hour on the open road. It is well enough, perhaps, for map problem purposes to strike an average. and assume such a figure as 20 miles an hour as the daylight motor movement speed. But for war (and possibly for the simulated wars of map problems, too) we are in need of better and more scientific data than that to go on —data that can only be determined by extended investigation and experiment along the lines suggested in this chapter.

Unquestionably, of course, many factors may reduce the average rate of a given motor movement below 20 miles an hour. Some of these we take consideration of when we assign set average speeds for night movements with and without lights, and for different kinds of motor vehicles.

But it is also true that by far the greater part of our motor transport, especially the organic transport that infantry may expect to have, will be capable of maximum running speeds up to 45 miles an hour under good conditions, and hence of an average rate of movement for several hours or a full day, of at least 30 miles an hour. Convoys of 50 and more trucks have little difficulty in

time of peace in moving 300 miles in a day at such speeds, this with towns and cities on the route and the usual civilian traffic on all highways.

There are, in fact, two sound military reasons for doing all we can to maintain the highest practicable speeds of motor movements. The first is, naturally, to get where we are going without wasting time. This needs no explanation. It is in essence Forrest's old precept with a modern application. The second, fully as important as, and hardly separable from, the first, is to clear the route as soon as we can so that other units can follow. This, indeed, may often be more important than the first.

DEFINITIONS

We are thus brought straight to the matter of road capacity and its relation to running speeds, road density, and road time. To make our discussion clear from the beginning let us first define "road capacity", and the other terms we shall use.

Road capacity we shall define as the maximum number of vehicles that can pass over a given *stretch* of road in a given time.

Running speed means the highest driving speed that is reasonably safe under a given set of conditions. Ordinarily we shall use this term in referring to maximum open highway driving speeds, and use the terms *reduced running speed*, or *city running speed*, as necessary.

Road density means the number of vehicles passing by a given point per hour.

Road time means the time required for a given unit to pass completely over a given length of road.

Average speed is the average rate at which a given motorized unit covers a given distance. The time of travel is calculated from the hour the first element begins a movement to the hour the last element completes it, and includes all halts.

FACTORS AFFECTING ROAD CAPACITY

Next let us list briefly the things that affect road capacity. These influencing factors are:

(1) The type of road (width, surface, curves, bottlenecks).

(2) Road condition (roughness, mud, ice, dust).

(3) Visibility (night, lights, fog, smoke, woods).

(4) Traffic conditions (one-way, two-way, cross traffic).

(5) Types of vehicles (speed capabilities, size, weight, cross-country capabilities).

(6) Condition of vehicles.

(7) Training and physical condition of drivers.

(8) The rate of travel.

That all these things may directly affect any motor movement requires no detailed explanation at this point. For the present, in order to bring out the discussion in logical sequence, let us consider only motor movements on hard-surfaced roads by vehicles capable of a safe maximum running speed of 45 miles an hour with average military drivers. Let us assume also that vehicles are in fair running condition. With these assumptions made we shall now consider in turn road capacities on highways of different widths and under different conditions of traffic.

ONE-WAY TRAFFIC

The simplest highway situation is that of a cleared one-way road without cross traffic. Peace-time motor columns seldom find this condition. In war, however, it is entirely possible for long stretches of highway to be temporarily closed for the one-way passage of large motor columns. (At main points where cross traffic is vital, temporary viaducts can be built over the road with little more work, if any more, than when engineers throw a

bridge over a stream.) Such a one-way road may be of one or more lanes.

CAPACITY OF ONE LANE

Let us begin with a single lane.

Under the conditions assumed we need to find only one more factor to determine how many cars can pass over a one-lane, one-way road in a given time. That factor is safe road distance, which depends only upon driver's reaction time—how quickly the average driver acts in applying his brakes after he notices the stop or slow down signal of the driver just ahead, or notices an accident of any kind. For full safety we must assume an accident that stops the car ahead suddenly, although such accidents would be rare on a one-way road without cross traffic.

The first two columns of Table III are from a table prepared by Mr. H. H. Allen, U. S. Bureau of Standards. Column (1) gives speed in miles per hour. Column (2) gives the distance in which a driver can stop his car when it takes him one second to change his foot to the brake pedal (which is more than twice as much time as the average driver takes to do this). Column (3) is column (2) plus a 20 percent safety factor, and column (4) is column (3) with 7 yards added for vehicle length.*

*The safe stopping distances given in this table are somewhat greater, and thus more conservative, than those recommended by two other authorities—*Sudden Death and How To Avoid It*, by J. C. Furnas and Ernest N. Smith (Simon and Schuster, New York, 1935); and *Guides To Highway Safety* (Institute of Government, Chapel Hill, N. C., 1935.) Both of these pamphlets are receiving wide distribution during the present safe driving campaign.

TABLE III

ROAD DISTANCES

Speed	*Stopping distance*	*Stopping distance plus 20%*	*Road distance per vehicle including 7 yards for vehicle length*
(mph)	(yards)	(yards)	(yards)
(1)	(2)	(3)	(4)
5	2.7	3.2	10.2
10	6.0	7.2	14.2
15	10.0	12.0	19.0
20	14.3	17.2	24.2
25	19.0	22.8	29.8
30	24.7	29.6	36.6
35	30.7	36.8	43.8
40	37.3	44.8	51.8
45	44.3	53.2	60.8

Now, using Table III as a basis, let us see how many motor vehicles can move past a given point on our road in an hour's time, (road density) including 7 yards as the length of a vehicle. Table IV shows this data.

TABLE IV

ROAD DENSITY

Speed	*Vehicles per hour*	
(mph)	*(with standard safety factor)*	*(with added military safety factor of 20%)*
(1)	(2)	(3)
5	905	860
10	1355	1240
15	1555	1390
20	1650	1455
25	1695	1475
30	1665	1445
35	1635	1410
40	1590	1360
45	1545	1300

Table IV indicates that road density is greatest at 25 miles an hour. But above that speed the loss in density is not great, as Table V shows.

TABLE V

LOSSES IN ROAD DENSITY AT SPEEDS ABOVE 25 MPH

Speed	*Loss in density above 25 mph*	
	(with standard safety factor)	*(with added military safety factor of 20%)*
(mph)	*(percent)*	*(percent)*
(1)	(2)	(3)
30	2	2
35	4	5
40	6	8
45	9	12

ROAD TIME ON A ONE-LANE ROAD

Road density, of course, is not what we are mainly interested in, although it is a factor of importance. Our chief concern is the time involved in moving sizeable motorized infantry units from one place to another. Hence, the real comparison we need to make is between increase in speed or rate of travel, and loss of road density. We can see merely by looking at Table V that the increases are much greater than the losses. Table VI shows the comparison.

TABLE VI

INCREASE OF SPEED COMPARED TO LOSS OF DENSITY ON A ONE-LANE ONE-WAY ROAD

Speed	*Increase of speed above 25 mph*	*Loss in density above 25 mph*	
		(with standard safety factor)	*(with added military safety factor of 20%)*
(mph)	(percent)	(percent)	(percent)
(1)	(2)	(3)	(4)
30	20	2	2
35	40	4	5
40	60	6	8
45	80	9	12

At 45 miles per hour, for example, a motorized unit covers 80 percent more ground at a loss in road density of only 9 or 12 percent, a loss that is negligible as a reason for not taking advantage of full safe speeds.

AVERAGE SPEEDS

Thus we arrive at the conclusion that 40 to 45 miles an hour is a reasonable running speed on good one-way roads without cross-traffic. This does not mean, however, that this speed can be maintained continuously. Grades, curves, and populous areas will all bring down the *average speed*. but not as low as 20 miles an hour under the conditions we have assumed (one-lane, one-way road without cross traffic). On modern highways few grades cause reduction in speed for any great length of distance or time, except in mountainous or semi-mountainous country. And except in such country, most or all of the time lost going up a hill can be regained by a slight increase above running speed as the hill is approached and after the hill

is passed. (Not on steep down grades, of course, but on more level stretches). Time lost by slowing down for a curve can ordinarily be made up by increasing speed for a short time after the curve is turned. Populous areas will cause a reduction in speed for turns, but only a moderate reduction on straight stretches (say from 40 to 30 or 25 miles an hour) if we assume, as would be true for important military moves, that a route through all towns and cities would be set aside and all cross traffic stopped. (Here, again, temporary overhead viaducts are indicated.)

Taken altogether, these causes, we must assume, will reduce average speed to something between 30 and 35 miles an hour. (We must remember, too, that accidents within the column may also contribute to lowering the average. These, and actions of the enemy, will be considered in detail later in this chapter.)

Let us take, then, an average speed of 30 miles an hour —which would call for a running speed of 40 miles an hour—, and see what the traffic will bear. At this running speed, the safe road distance per vehicle (including the vehicle itself) is from Column (4), Table I, 52 yards, —that means 34 vehicles per mile.

So far, however, we have been considering only a *one-lane*, one-way road, a type of road seldom if ever found as a highway. (Many roads in our country were originally built as one-lane roads with firm shoulders for turning out, but the greater part of these have been replaced by 18-ft. (two-lane) roads.) Consequently, up to this point, this analysis has only applied, in effect, to one-half of the road.

But how can we use the other half?

CAPACITY OF TWO-LANE, ONE-WAY HIGHWAYS

It is entirely possible to use 18-foot, two-lane highways for one-way traffic very much as a two-track railway is used. This could be done by staggering the vehicles on

the two lanes so that although full road distance is observed in each lane, the actual road distance, taking all vehicles into consideration, is half road distance. There is nothing dangerous or fantastic about this. It is done daily not only on two lanes, but on three and even four parallel lanes, by hundreds of thousands of motorists on the wide highways leading into our largest cities. (These drivers, moreover, do not have the advantage of military training and control, and the uniformity of vehicle as to speed and condition that would obtain in army transport. They must continually watch out for the other fellow, passing and being passed many times an hour.)

By thus doubling up, using both traffic lanes, we would increase our road capacity to 68 instead of 34 vehicles per mile, which, at an average speed of 30 miles an hour, means that 2000 vehicles could pass a given point per hour.

ROAD TIME ON A TWO-LANE ONE-WAY ROAD

Now let us see what this means in terms of getting places with troops. For one thing, it means in terms of motorized infantry that 7 infantry regiments* of the proposed type described in Chapter 1, Volume XI, The Mailing List, can be moved down a single road per hour. The column would be 30 miles long moving, and about 10 miles long parked. Assuming no delay during the period of extension of the column to its full length or during the

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*This assumes 173 organic motor vehicles (not including motorcycles), plus 109, 1½-ton trucks to motorize the rifle battalions of all regiments. Some motorcycles would be in column, but many of them would be ahead of the column in the advance traffic detail. With a total of 282 motor vehicles in each regiment, the actual figure is 7.1 regiments. If 40-passenger busses were used for rifle companies, the figure would be 9 regiments, allowing for some increase of road space for busses.

arrival at destination, such a column could move 150 miles in 6½ hours, or 250 miles in 10½ hours, including stops for refueling and rest or calls of nature.**

Delays in getting started and in reaching destination depend entirely on the care with which preliminary and arrival arrangements are made. We have given considerable attention to entrucking and detrucking arrangements in the past. Only a few special points need be touched upon here.

Departure should take place so that units follow in succession without interval. Whatever the size of the column, the leading vehicle moves out to running speed as rapidly as it can accelerate and the others follow increasing slightly above running speed if necessary to close up.

At destination there must be complete parking or distributing arrangements. There is no point in hurrying if the time thus gained is to be wasted in a traffic jam at the end of the run. And if things are handled efficiently at that end by advance traffic details, there should be no jams, always excepting the possibility of hostile interference.

Table VII shows the road time on the basis of the foregoing data for columns of different sizes travelling distances from 50 to 300 miles. These include halting periods

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**Two 15-minute stops on a 150-mile run; one 20-minute stop for refueling, and three other 15-minute stops, on a 250-mile run. It is assumed that troops will eat while travelling. On runs of 150 miles or less, one 15-minute stop may be made instead of two, or if the emergency warrants, none at all. All halts are made without closing up.

TABLE VII

ROAD TIME (DAYLIGHT) FOR A RUNNING SPEED OF 40 MPH AND AVERAGE SPEED OF 30 MPH ON A TWO-LANE, ONE-WAY HIGHWAY

Size of Motor Column	*Length of Column*	*Distance of Movement* (miles)					
		50	100	150	200	250	300
(vehicles)	(miles)	(hr.)	(hr.)	(hr.)	(hr.)	(hr.)	(hr.)
100	1.5	1.7	3.6	5.3	7.7	9.4	11.4
500	7.4	1.9	3.9	5.5	7.9	9.6	11.6
1000	14.8	2.2	4.1	5.7	8.2	9.8	11.8
2000	29.5	2.7	4.6	6.5	8.6	10.6	12.3
3000	44.3	3.1	5.1	7.0	9.2	11.1	12.8
4000	59.0	3.6	5.5	7.5	9.6	11.6	13.5
5000	73.8	4.4	6.0	8.0	10.4	12.1	
6000	88.5	4.8	6.8	8.4	10.9	12.6	
8000	118.0	5.9	7.8	9.8	11.9	13.8	
10000	147.5	7.1	8.7	10.8	12.8		

(Notes: 1. Halts of 15 minutes for each 3 hours are included.
2. One 30-minute halt is included for all distances over 150 miles.
3. Total daylight of 14 hours is taken as a maximum.)

Suppose that a commander wants to move a fully motorized infantry brigade (approximately 700 vehicles) a distance of 150 miles, over an 18-foot highway, using the method described above.

(1) The whole trip would take roughly 5.6 hours, not including entrucking and detrucking.

(2) The column would be about 10 miles long moving.

(3) At any given point the road need be blocked to cross traffic for only 20 minutes.

But suppose, on the other hand, that the movement is made in single column at 20 mph. with 35 yards road distance per vehicle (including the vehicle).

(1) The whole trip would take roughly 9 hours and a quarter, not including trucking and detrucking.

(2) The column would be about 14 miles long.

(3) At any given point the road would be blocked to cross traffic about 40 minutes.

Let us make a second comparison, using the long road distance (100-250 yards) for high-speed convoy travel as now taught at The Infantry School. Taking 150 yards as road distance, and 30 miles an hour as average speed, we find that:

(1) The whole trip would take 7.5 hours, not including trucking and detrucking.

(2) The column would be 59.5 miles long.

(3) At any given point cross traffic would be seriously interfered with for 2 hours.

Table VIII shows the comparison clearly.

For a brigade, or any size of unit, the method of moving motor vehicles suggested in this chapter indicates material advantages that deserve close study and experiment.

HEAVY VEHICLES AND MIXED UNITS

There has been no mention yet in this discussion of heavy vehicles or mixed units. Only infantry movements have been considered. More often, perhaps, we shall want to move as rapidly as we can with forces of all arms.

In this regard, the force of 7 infantry regiments (approximately 18,000 men) mentioned above is roughly the equivalent of an infantry division. In such a column of all arms, vehicles too heavy to maintain a running speed of 40-45 miles an hour would have to be formed in a

TABLE VIII

150 MILE TRIP OF A BRIGADE

Type of column	*Time of travel* (hr.) (1)	*Length of column* (mi.) (2)	*Interference with cross traffic* (min.) (3)
Staggered double column (average running speed, 30 mph.; road distance in each lane, 52 yd.)	5.8	10.2	20.5
Single column (20 mph., 35-yd. road distance)	9.2	13.9	41.7
Single column (30 mph., 150-yd. road distance)	7.5	59.6	119.2

separate serial and follow in rear. But modern 2½- and 3-ton trucks are capable of these speeds, and so are truck-drawn field artillery, and large busses also if these are used. For these heavier vehicles in the column, an increase of road space not to exceed 50 percent would be the main consideration. How much of an extension this would make for the whole column we cannot tell, of course, until we know what a fully motorized division comprises. It is safe to say, however, that this extension would increase the total running time of a division by less than 15 minutes, under the assumed conditions of a two-lane one-way road.

The heavy vehicles, which would follow the column in rear, would include 5-ton ordnance maintenance trucks, and probably heavy water trailers, and tank trucks. At the same time, we should remember that far heavier civilian vehicles than these habitually travel 18-foot roads at running speeds of 50 miles an hour and more.

COMPARISON TO ACTUAL TRAFFIC CONDITIONS ON HIGHWAYS

This is enough to indicate the reasonable possibilities of military traffic on a two-lane, one-way highway under the best conditions of traffic control, weather, visibility, etc. But before we go on to consider other conditions and other kinds of roads, we may consider in brief whether the road capacity we have so far discussed is actually a maximum, and how it compares to actual daily traffic conditions on highways.

Mr. H. C. Dickinson, U. S. Bureau of Standards, is quoted in the report on "Traffic" in American Road Builders Association Bulletin No. 23, mentioned above, as follows:

. . . in general the distance apart of cars in traffic is controlled by several factors, the most important of which is the time required for the driver to note that the car ahead is slowing down and then to apply his own brakes. If the stopping distance of all cars were alike and *if drivers were liable to use the full power of the brakes** the above would be about the whole story. It would, of course, be somewhat different for different people and would be different for night and day.

As it is, however, there are two important elements depending on the brake performance (of vehicles in highway traffic). These are (1) differences in braking ability, requiring that each driver assume the car ahead to have the minimum stopping distance whatever his own car may do; and (2) *the practical assurance that the driver ahead will not use anything like his full brake capacity without warning.*

(Of these, we can assume as regards (1) that brakes on military vehicles will be in better condition than those on average civilian vehicles.)

To continue the quotation:

Practically this item (2) is very important, particularly in close lane traffic in municipal areas. Every driver seems to take for granted that the driver ahead will not

*The italics throughout this quotation are the editor's.

stop suddenly without warning except in an emergency and *the driver behind is in almost as good a position* to appreciate the emergency as the driver ahead. It results therefore in practice that cars are driven considerably closer together than would be safe except for this assurance, together with the reserve braking ability which is available if the car ahead is only moderately braked. At lower speeds this seems safe hence the traffic capacity at speeds under 25 miles an hour is relatively greater than indicated below.

On the assumption of cars 5 yards long driven at a headway corresponding to 1½ seconds of time required to cover the intervening distance at the various speeds the traffic capacity on *a single traffic lane* is as in Table IX.

TABLE IX

"*Speed* (mph)	*Capacity* (cars per hour)
5	1,180
10	1,780
15	2,140
20	2,380
25	2,560
30	2,700
35	2,800
40	2,880
45	2,940"

This analysis indicates that if military vehicles were driven with the minimum safety allowances that are common in free-flowing commercial traffic, more vehicles could be driven on *a single lane* at 40 miles an hour than we have assumed for two-lanes at the same speed. Hence our assumed traffic flow is far below the maximum possible.

Furthermore, this data suggests what might be accomplished if special attention were given to training drivers in operating under traffic conditions comparable to those Mr. Dickinson considers above. And as he suggests, this has a particular application to traffic in crowded areas at speeds under 25 miles an hour.

Here are some figures on actual traffic taken from the same report.*

Under extraordinary conditions, the maximum practicable capacity of a single lane of motor vehicles is approximately 1800 vehicles per hour. This is on the assumption of an uninterrupted flow, free of interference by cross traffic. The figure * * * represents a condition of congestion which would be neither convenient nor satisfactory to the operator of vehicles. The figure of *1500 vehicles per lane per hour* for a highway with no grade crossings represents the practical maximum at satisfactory speeds. (See Table X also.)

* * * * * * *

TABLE X

RELATIVE CAPACITY OF MULTI-LANE STREETS IN COMPARISON WITH SINGLE LANE

No. of lanes in one direction	*Efficiency per lane in percent of single lane*
1	100
2	89
3	79
4	70
5	62

The capacity of roadways of various widths is, therefore, readily determined. This calculation can be made under three conditions:

(1) Express movement on a roadway with no grade crossings and no stopping permitted.

(2) Movement on a roadway such as a city boulevard subject to grade crossing interference, but with parking prohibited.

(3) Movement on a roadway with normal grade crossing interference and with the further reduction in capacity resulting from stopping and parking along the curb line.

These capacities are as shown in Table XI.

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*Mr. Charles Gordon, Managing Director, American Electric Railway Association.

TABLE XI

MAXIMUM PRACTICAL CAPACITY PER HOUR OF ROADWAYS UNDER TYPICAL CONDITIONS

Roadway width in one direction	*No Grade Crossings. No stopping permitted*		*City Boulevard with grade crossings —Parking prohibited*		*City Streets with grade crossings— Parking permitted*	
	No. of moving lanes	*Vehicles per hour*	*No. of moving lanes*	*Vehicles per hour*	*No. of moving lanes*	*Vehicles per hour*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
20 Ft.	2	2,650*	2	1,200	1	750
30 Ft.	3	3,550	3	1,800	2	1,450
40 Ft.	4	4,200	4	2,200	3	2,000

*New Jersey State Highway Department estimates 2,400 cars per hour under similar conditions on Route No. 25, which is an elevated express highway.

The foregoing table, it should be remembered applies to free flowing traffic, which does not necessarily stay in the same lanes, as contrasted with the military columns we have heretofore discussed, which would remain in their own lanes throughout a run. The slightly wider roadway of 20 feet as compared to 18 feet makes little difference especially when vehicles do not pass one another. Unfortunately, speeds are not given in Mr. Gordon's discussion.

Here are two other pertinent quotations:

When traffic on two-lane roads is 80 to 100 percent in

one direction congestion does not occur until vehicles are passing at a rate exceeding 1300 per hour.*

The Holland Tunnel, with two lanes in each direction (one for slow traffic and one for fast) has a record capacity for one hour of 2,507 cars on the two lanes combined, and a record for a single half-hour of 1422 cars.** The average speed maintained is about 30 miles an hour, with 25 to 30 yards between cars. (In the tunnel the lighting, noise, and grades contribute to requiring a greater road distance than is common on open highways.)

These quotations from authentic sources show plainly that the deductions made in this chapter as to the possibilities of military highway traffic are in no way exaggerated. Indeed, they are moderate, if not ultra-conservative; for a considerable factor of safety has been included over and above that obtaining daily on the busy highways of our nation, or considered necessary by traffic engineers of ability and experience.

It is desirable, of course, to include this added safety factor since accidents cause delays and must therefore be minimized. But on one-way roads without cross traffic, serious traffic accidents should be rare. With all vehicles moving in the same direction and at standard distances head-on collisions are hardly possible. The worst type of accident that is at all liable to occur is a vehicle turned over from loss of control as the result of a blow-out. In such an accident, however, the vehicle does not stop dead but continues on for some distance, so that vehicles in rear have opportunity to stop or enter the interval between vehicles in the other lane and pass.

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*Dr. A. N. Johnson, Dean of Engineering, University of Maryland.

**Up to 1931. Mr M. O. Eldridge, Assistant Director of Traffic, District of Columbia.

THE AFFECT OF REDUCING SPEED

When a motor column is moving at full road distance and running speed, and for any reason the speed of the leading vehicle is reduced, the vehicles in rear must also reduce speed. This reduction affects the whole column. In making a sharp turn, for example, it is usually necessary to reduce to 10-15 miles an hour. Once the turn is made each vehicle can immediately increase again to running speed, although it must slow down for the turn. Such delays, however, are not cumulative. The total delay for the column is the time it takes one vehicle to slow down, round the turn, and pick up speed again. Actually, if each driver begins to reduce speed for the turn at the same point, road distances throughout the column will remain approximately the same during the turn as before and after.

Let us say, for example, that each vehicle begins to reduce speed from 40 miles an hour 100 yards before reaching the turn and gets back to that running speed 100 yards after completing the turn. The delay to the column, then, is the difference between the running time for 200 yards at 40 miles an hour and the running time for 200 yards at an average speed of $(40 + 10)/2$, or 25 miles an hour. This is roughly 6 seconds. In thus making a turn each vehicle preserves approximately its safe driving road distance of 14.2 yards for 10 miles an hour. Individual differences in the way drivers make a turn may sometimes cause a small amount of jamming. This can largely be eliminated by correct driver training.

But suppose a bad stretch of road of some length, let us say 1 mile, causes a reduction in speed to 10 miles an hour. Here the same thing happens as before except that the delay to the column is longer, 270 seconds, or 4.5 minutes.

In any case, so long as the vehicles keep moving at a fairly constant speed, there should not be any great

amount of closing up or extension in the column, whatever its length. And if adequate route information is obtained or provided in advance, it should be possible to estimate the reasonable running speeds for all parts of the route, and for logistic purposes, the amount of delay for the whole route, and hence the average speed and the road time of the column.

When, however, it is necessary to slow down for any reason much below 10 miles per hour the delay is cumulative back through the column. On main highways under the conditions we have assumed, this should seldom be necessary.

Narrow places in the road may require the formation of a single column at half road distance in place of a staggered double column at full road distance in each lane. The statement has often been made that "a road is no wider than its narrowest point". To the contrary, for short distances such as the length of a short bridge or viaduct, vehicles should be able to pass with reasonably careful driving at half the road distance we have assumed for a staggered, two-lane formation. (This, at 40 miles an hour, would be 25.9 yards per vehicle including the length of the vehicle.) For long distances, of course, over which the road is less than two-lanes wide, a reduction of speed would be necessary, and the resulting delay would be cumulative. From column (4) of Table VI, we see that half road distance (25.9 yards) is safe for a 20-mile-an-hour speed. Hence, without elongation of the column as a whole, the vehicles in one lane could move into the intervals between the vehicles in the other and pass over narrow, but otherwise good stretches of considerable length at half-running speed, or 20 miles an hour.

If the narrow stretch were also bad enough to require a reduction to less than 20 miles an hour, the 25.9-yard road distance should be maintained without closing up so that when the road opens out again, double staggered

column can be formed and running speed resumed with ease.

DELAYS DUE TO STOPPING

When any part of a motor column halts so that vehicles in rear cannot pass, the vehicles in rear must halt also, except that a brief halt in a long column may eventually be absorbed by temporary reductions in speed and road space. But except for specific purposes such as refueling from tank trucks, the vehicles in a column moving in double staggered formation on two lanes, should be halted at half road space so that there will be room to turn around individually if necessary. And at all halts for any reason a single column should be formed.

Whether the column closes up in part or in full, or halts at half road space as just described, the delay to the whole column is approximately the halted time of one vehicle plus the extra time over and above running speed required for one vehicle to slow down to a halt and also to accelerate to running speed again. (This assumes that, as in beginning a motor movement, each vehicle is accelerated to running speed without delay, and that a speed slightly over running speed is maintained when it is necessary to overtake preceding vehicles.)

ACCIDENTS

Accidents may occur in any motor movement, it goes without saying. However, on a one-way road closed to cross traffic, they should be fewer than under ordinary conditions of two-way (or even one-way) peace-time traffic.

There are about 25,000,000 automobiles in the United States. These vehicles average about 8,000 miles of yearly travel, which gives us the astronomical figure of

200,000,000,000 total car-miles. There are some 1,200,000 automobile accidents per year, or one accident for every 165,000 car miles. From this we might assume that if 2,000 military vehicles move 150 miles (300,000 car-miles), a normal expectancy of accidents is 2.

Certain factors would, however, favor military highway traffic over ordinary traffic:

(1) No cross traffic. (About 20 percent of peace-time traffic accidents occur at crossings.)

(2) Better drivers. (There are roughly 1,000,000 men in the United States gainfully employed as chauffeurs and drivers. Of these, several hundred thousand are employed by large companies that demand a high order of driving and maintenance ability. A war army should receive enough such drivers to fill most of its needs.

(3) Fewer pedestrians. (A large number of peace-time accidents involve pedestrians. The probability of pedestrian accidents during a military movement on a two-lane, one-way highway would ordinarily be much reduced.)

(4) Better general driving conditions. (Standard rules of the road, safe road distances, the use of relief drivers, better condition of military vehicles than of the average civilian car—these and other factors reduce the probability of accidents.)

Thus there is every reason to believe that a military motor movement would, except for possible hostile action, involve far fewer accidents than an equivalent amount of peace-time highway traffic.

When accidents do occur immediate action to clear the highway must follow. Vehicles with mechanical or tire failures must move well off the road immediately or must be shoved off by trucks in rear. More serious accidents must also be cleared away at once. Minor accidents should delay the column very little and major accidents will delay

it only for the period of time that the road is completely blocked plus the time it takes one vehicle to decelerate to a halt and accelerate from a halt to running speed.

OTHER TYPES OF ROAD

Heretofore, in this chapter, we have considered for the most part a single type of highway—the two-lane, one-way, hard surface road. This kind of road was selected for the main discussion, first because motor movements can be made to best advantage over such roads, and second, because our automobile civilization has compelled the building of 18-foot or wider roads of this type on most of the principal road net of the United States. It would be difficult to imagine a situation in any area of the United States in which at least one main highway would not be available for a large motor movement, although it it true that some areas have a sparse road net.

TYPES OF ROADS AVAILABLE

Table XII shows the approximate total road mileage of the United States according to main types of roads.

Of the mileage shown in Table XII, it is safe to assume that at least three quarters of the first type listed is 18 feet wide or wider, forming main highways. (78,000 miles of the 111,000 shown is surfaced with cement concrete. This type of surface is not often used on other than main highways.) From this we gather that roughly 20 percent of the highways in this country are roads on which motor movements could be made as described earlier in this chapter. And of these roads more than half the mileage lies in States along our borders or coastal frontiers.

In any military situation we must use what roads exist. But the table on the next page indicates that in our own

TABLE XII

ROAD MILEAGE IN THE UNITED STATES

Type	*Miles*
High-type (cement concrete, sheet asphalt, asphalt concrete, etc.)	111,000
Macadam, gravel, and similar hard surfaces	148,000
Sand-clay and top-soil	14,000
All other types of roads under State highway departments	71,000
Total mileage under State highway departments	344,000
Connecting roads through cities and towns	16,000
Total	360,000

country the road net of high-type highways would often afford one or more routes for any movement desired. Moreover, the total mileage of good roads is constantly increasing.

WHEN SECOND-RATE ROADS MUST BE USED

When second-rate roads must be used for part or all of a motor movement, it will often be impossible to move vehicles in double column, on two lanes or at a running speed of 40 miles an hour. It is possible, however, to determine road width, road speed, and road distance data for all main types of road surface, and for all weathers and visibility conditions. This is done in part now in existing tables of rates of march. But in these tables we have only one speed given for each type of vehicle for all roads. If the logistics of any extended motor movement are to be estimated with even fair accuracy, we shall need to have running speeds for different types of roads as well. Table XIII shows a type of table of daylight run-

MAILING LIST——9.

TABLE XIII
DAYLIGHT RUNNING SPEEDS

Type of road	*Condition of road*						*Visibility*			
Surface	*Good*	*Rough*	*Mud*	*Ice*	*Wet*	*Dust*	*Dry*	*Rain*	*Snow*	*Fog*
Concrete	40	30	—	25[1]	35	—	40	25-35	15-30	5-15
Asphalt	40	30	—	25[1]	30	—	40	20-30	15-30	5-15
Gravel	40	20	30	30[1]	30	30	30-40	20-30	15-30	5-15
Sand-clay	40	20	15[1]	15[1]	15[1]	25	25-40	15-20	15-20	5-15

NOTE.—[1]With chains.

ning speeds and road distances for vehicles capable of safe driving at 45 miles an hour under the best conditions.

Many of the rates given in Table XIII are estimated and not based on actual experiment. It would not be difficult, however, to complete such tables for logistic uses. Similar data could also be determined for night movements with and without lights.

Then, when route information was obtained as described in the foregoing chapter, all routes would be checked as to condition and all probable deviations from table running speeds would be noted as pertinent information.

HOSTILE ACTION AGAINST MOTOR COLUMNS

A full consideration of the methods of hostile action against large motor vehicle movements of the type we have discussed is beyond the scope of this article. Hostile action is possible from air and ground and its probability depends on many factors. We can, however, touch briefly upon a few main points here.

HOSTILE AIR ACTION

Hostile action from the air may consist in an attempted blocking beforehand of defiles (including bridges) or stretches of the route by bombardment, or an actual attack upon the column itself by bombardment or attack aviation. The blocking of routes by bombing done some time before a large motor movement would usually, we can assume, be in the nature of a general protective measure by a hostile force and not directed against a specific movement unless hostile intelligence received advance notice of an intended move. It goes without saying that surprise is highly important here as always. Surprise could take the form, however, of a rapid night repair of a blocked route including construction of bridges

that were out. Again, the situation may be such that a hostile commander hesitates to block routes he may desire to use himself.

As for a direct attack on the column, air superiority, or at least substantial protection against hostile observation, would ordinarily be requisite insurance. But it should be remembered also that it may take some time for hostile observation to discover a movement even when there is little protection, and that some more time is required for a hostile air force to be notified and arrive in position to attack or bombard a column.

HOSTILE GROUND ACTION

Direct hostile ground action, we can assume, would not be forthcoming against a rapid motor movement until the enemy learned of the movement or unless the enemy knew of the movement in advance. General measures to block approaches from any direction might, of course, be taken by the enemy at any time. Here a ring of distant reconnaissance detachments around our force, "outposting the enemy" even more than our own troops, would come into play. An active pushing forward in several different directions, or a normal activity along reconnaissance strips previously established, are two possible ways of deceiving the enemy.

APPLICATION TO MECHANIZED FORCES

Before concluding, it should be pointed out that practically everything contained in this chapter is also applicable to movements of mechanized forces. In a rapid movement by such forces, it would usually be desirable for the fighting vehicles to move in one serial and their maintenance vehicles in another following serial.

CONCLUSION

This chapter has mainly pointed out the possibilities of highways as to vehicle capacity and suggested methods of using them in war. There should be no doubt in the reader's mind that what has been indicated in this chapter is not a standard method of motor vehicle movement for use under all conditions. When there is time, single columns of vehicles with doubly ample road distance are often desirable. But when the tactical or strategical demands are great, methods similar to those discussed in this chapter would give us "all the traffic will bear", and those are the times we shall need it.

CHAPTER 13

Infantry In Jungle Combat

(INFANTRY SCHOOL TEACHING)

We can define jungle combat as any warfare in which the theater of operations is largely covered by a heavy growth of vegetation—a growth that greatly hinders vision, movement, and fire. The primary characteristic of jungle warfare, in other words, is obscurity.

The vegetation may be tropical jungle, heavy woods filled with underbrush, thick mesquite or shrub, or high thick grass. The great sugar-cane fields of the Philippines and the dense vine-twisted growth of the flatter jungle areas of Panama are examples of one extreme. The jungle-crowned hills and mountains of both are examples of the other. The terrain may vary from flat to mountainous. The climate may be hot or cool. But whatever the vegetation, if it is a serious obstacle to vision, movement, and fire, it calls for a distinctive type of combat.

The virgin jungle, although it is not impenetrable, is difficult to traverse. Movement through it is generally limited to narrow trails, either trails that already exist or those that have to be cut through by troops for a specific purpose. These trails are usually passable only on foot, or by horse or pack transportation. The heavy rains that cause the tropical growth also add to the difficulties of movement during much of the year, turning trails into mud tracks and small streams into torrents.

Inasmuch as vision in the jungle is limited, observation is correspondingly reduced, thus making the problem of security and control most difficult. Columns are neces-

sarily lengthened owing to the impossibility, in most jungle terrain, of marching other than in single file.

In general, progress through the jungle can be made only by using old trails or cutting new ones. Old trails are usually in poor condition, meandering aimlessly around hills and fallen trees, and across streams. Thus it is difficult to follow a compass direction while following a trail. Bridges are either non-existent or poor. Accurate maps seldom exist. Trail junctions and crossings are confusing networks of tracks and often lead to loss of route. On maps of 1/20,000 and smaller scale, trail distances are roughly twice as great as the map indicates. New trails, cut as a column progresses, are usually straighter and more direct than existing trails used by natives. The work of cutting away enough underbrush and vines to allow a column to pass is slow, tedious, and difficult. However, through soft dense jungle, where machetes or other large knives can be used, as in Panama, a fair rate of progress can be made by systematic cutting in which frequently relieved relays of trail cutters precede a column.

DECENTRALIZATION AND INITIATIVE

Jungle terrain, because of low visibility, poor means of communication, and the difficulties of movement and control, is conducive to the organized action of small units only. Hence jungle combat training should stress decentralization by commanders and initiative in subordinates.

Most jungle fighting of necessity resolves itself into a series of personal encounters, or combat by small groups. Ordinarily, a company commander can have little influence on the result of an action except through his assignment of missions and distribution of troops prior to the action, and through shifting his troops or occasionally leading his reserves, after the fight has begun. He must usually be content to let his subordinates carry on the fight. Unit commanders can, however, accomplish much

in training. Instruction should be such that subordinates, commanders, and men are made to understand conditions that may confront them when they approach and meet an enemy in the jungle.

TRAIL MOVEMENTS BY LARGE FORCES

Because of the narrowness of trails, low visibility, and poor communications, the offensive power of a large force is seriously impaired in the jungle. Not more than one or two of the leading squads of each column can fight on the trail. Owing to the difficulty of control, not more than a platoon, or rarely a company, can deploy off the trail. Large forces are therefore not likely to seek their decisions in the jungle. The jungle is merely an unfortunate obstacle through which they must penetrate in order to seek a decision beyond. On the other hand, it must not be assumed that because the destructive power of a large force is reduced by the jungle, its ground-gaining power is lost. By the simple expedient of outflanking by groups headed by trail cutters, a large force can force a small one to withdraw, although the time required to cut around makes such a operation much longer than a like maneuver in more open terrain.

Since large forces cannot be employed on trails, or deployed away from trails, there is no advantage gained in holding all of a large force on a single trail. The passage of a large force through a jungle area would usually consist of independent marches of separate columns on as many parallel trails as can be found in the area to be traversed. Some columns may have to move across-country cutting trails as they go. Each column must normally move in single file, and provide its own advance guard, which may vary from a company to a battalion. We thus have the probability, in a large command, of several independent columns, each with a battalion or

smaller unit continually outflanking resistance ahead. There can be practically no intercommunication or mutual supporting action between such columns. Coordination can be effected only through the initial plan of march, with suitable provision for concentrations when cleared areas are reached. This procedure is not unduly dangerous, since each column, in the jungle, should be well able to defend itself in case the enemy attempts to act against separate columns in detail. Moreover, in an emergency it may often be possible for columns advancing on parallel routes to cut new trails across in order to reinforce a column in distress, although, as we have seen, such movement is slow.

OFFENSIVE ACTION IN THE JUNGLE

A column moving through the jungle on an offensive mission is faced with a difficult problem in providing security. It must always have an advance guard large enough to furnish protection for itself and hold off an enemy until the main body can prepare for combat. Flank protection by flanking detachments is seldom possible; such detachments would of necessity be forced to cut trails for their own movements, thus materially reducing the rate of march of the main body. A column must depend for flank protection on its alertness and its ability to defend itself in close combat if ambushed. A rear guard large enough to protect itself against ambush should also be provided.

Offensive combat in the jungle differs from that in more open terrain in that the action of troops is confined almost entirely to the close vicinity of the trail along which a column marches. The leading elements are usually the only ones initially able to engage an enemy attempting to stop a forward movement. In the thickness of the jungle, frontal attacks are seldom practicable. Opposition by small enemy forces must be flanked by en-

circling detachments, headed by cutters making a path through the jungle. When more determined resistance is met, it may be necessary to halt the column for a considerable time in order to cut trails around a hostile flank and move flanking detachments over these trails.

Weapons valuable for offensive action in open warfare are not always suitable in the jungle. The machine gun, for instance, is of little or no value as an offensive weapon, and its presence in numbers merely adds weight to be carried, and reduces the fighting effectives by the number required to transport them. In case, however, a need for them can be foreseen after emerging from the jungle, they should be included. Similarly the 37-mm gun and the infantry mortar are not adapted to offensive use in the jungle. Both depend for efficiency on observation of fire, which is obviously impossible in dense undergrowth. Like machine guns, however, they may be useful, on reaching open terrain. The automatic rifle is valuable for its fire, but inasmuch as jungle combat usually ends in hand to hand fighting, the automatic rifleman is at a distinct disadvantage.

The offensive action of individuals and small groups, ending in close combat, will usually be the deciding factors in a jungle fight. The weapon best adapted to such combat is the rifle with its bayonet. Therefore the rifle should be included in sufficient quantities and is to be preferred when a choice of arms must be made.

The bayonet is not a satisfactory tool for cutting paths through the jungle. Bolos, machetes, or other large knives should be provided for this purpose. The heavy issue bolo is unsatisfactory. The tool needed should have a blade about two feet long but not a heavy blade. The Panamanian machete, the best type of jungle-cutting tool, is on the order of a long butcher knife, a little heavier and somewhat narrower in the blade in the half of the blade nearest the handle.

DEFENSIVE COMBAT IN THE JUNGLE

Defensive action in the jungle can be more carefully planned than offensive action. The defender often has his choice of terrain and location, and in some situations can prepare his positions to a considerable extent. On the other hand, the offensive choice of movement imposes considerable uncertainty upon the defense, and may result in carefully prepared defensive plans going astray. It is generally best, therefore, not to tie a defense down to position defense but rather to regard the jungle as a defensive area in which all the means of stopping and defeating an advancing enemy can be used. The methods used may culminate in the final occupation of a key position if one exists. Defensive measures, then, may be classified generally under one or more of the following heads:

(1) Delaying actions.
(2) Harassing action.
(3) Counterattack.
(4) The occupation of a position.

DELAYING ACTIONS

It is generally true of any jungle operations that the advantages of time are with the defender. Time exhausts the enemy's supplies, weakens his physical resistance, annoys him, and lowers his morale. Time can be gained for the defender by the proper use of delaying actions.

Relatively small forces can, if rightly employed, deny the use of trails to hostile advance elements. The ideal of delaying action is, therefore, to require the enemy—or at least his advance elements—to traverse the entire jungle without allowing him the use of existing trails. This ideal can seldom be fully accomplished. An alert

and skillful commander may approximate it, however, by organizing in depth the trails over which an enemy is advancing, thus requiring his columns to use flanking detachments, which must cut their way around the successive delaying positions. Delaying positions should be as close together as conditions permit, and should be so selected as to permit the delaying force to withdraw with reasonable safety.

HARASSING ACTION

Harassing action differs from delaying action in that it aims to strike at an enemy's flanks, rear, trains, bases and camps, rather than at the leading elements. It is a means used to annoy and demoralize a hostile force.

The harassing force should operate independently, and should have no security missions other than its own protection. It is used to strike frequently and unexpectedly at enemy columns and installations. After an attack it withdraws by previously selected routes. Several harassing forces may operate at the same time against different enemy sensitive points.

The primary harassing measure is the ambush. The ambush is executed by a selected force, from concealed positions, generally on enemy flanks. The ambushing force makes no attempt to delay the enemy, but allows the hostile column to pass until the element which it is desired to strike comes within reach. When this occurs, fire is opened on signal, and an attempt is made to destroy or demoralize that particular part of the enemy column. The ambushing force withdraws before a general engagement can be brought on.

COUNTERATTACKS

Counterattacks may be employed when troops are available and the situation seems propitious. They are generally in the nature of harassing action on a large scale, in which troops are assigned areas, or zones of attack, which can be reached by covered routes. The principle of surprise should be employed to the maximum.

POSITION DEFENSE

The occupation of a final position is generally resorted to only after other defensive measures have failed to stop the enemy. Good positions should have strong flanks difficult to turn. When time is available, lanes of fire are cut for automatic weapons and fields of fire cleared for riflemen. When time is not available for organizing the position, its defense is necessarily decentralized. Success will then depend on the ability of small groups to resist an assault. In such cases there is little a commander can do to influence the action other than to commit the reserves that may be available.

Machine guns are of some defensive value in the jungle. In harassing or delaying action they are useful when positions can be found from which fire can be delivered down a considerable length of trail. When machine guns are so used, they should be withdrawn from action to the rear before capture becomes imminent. Machine guns may be of great value in position defense provided time is available to cut lanes of fire for them; but when that cannot be done the effectiveness of their fire is negligible. In rolling jungle country when accurate maps can be obtained, the indirect fire of machine guns can be used to interdict trails and stream crossings.

The infantry mortar, depending as it does on observation of fire for effectiveness, has little place in the jungle.

The same is true of the 37-mm gun except in jungle suitable for tank operations; here it is valuable against tanks. The decision as to whether to include these weapons in a force operating in the jungle, depends, therefore not only on the character of the jungle, but also upon the enemy's armament, and the probable need for these weapons after open terrain is reached.

TANKS IN THE JUNGLE

In some types of jungle tanks would be very useful, both offensively and defensively. Tanks cannot operate to advantage in swampy country or through heavy woods. But with firm footing they can move easily through heavy brush or high grass. When they are used every advantage should be taken of the element of surprise.

Offensively, tanks may be of value in flanking or overrunning delaying detachments, or in the assault of prepared positions. Defensively, they may be used in harassing or delaying action. A single tank running down a trail filled with men unable to take adequate cover, can cause damage sufficient to disrupt a march for a considerable period of time. At the same time, it should be remembered that the poor visibility within jungle areas decreases the effectiveness of tank operation and fire.

Tanks may also be of great help in clearing fields of fire for a defensive position in jungle country through which they can run. They simply run through the vegetation beating down lanes.

ANTITANK MEASURES

The 37-mm gun or the caliber 0.50 machine gun offers our best infantry defense against tanks. When an enemy is expected to use tanks, these antitank weapons should be included in the armament of troops operating in the

field. The guns are employed defensively by placing them at intervals throughout a marching column; or, when the column is at a halt, in positions covering the most likely avenues of tank approach. In either case they should be ready for prompt action.

HUMAN LIMITATIONS

The tropical jungle calls for many special safeguards beyond those of a tactical nature. For example, it is only through training and correct precautionary measures that the evil effect of tropical climates can be minimized. Particular care has to be taken against malaria, dysentery, and other tropical diseases. These require a rigid training in, and adherence to, important sanitary principles. Men who are unaccustomed to the tropics—and even those who are, including natives,—are not capable of as much physical accomplishment in a given period of time as in more moderate climates and less difficult terrain. All these things a commander must consider in conducting his forces through the rigors of a tropical campaign.

CONCLUSION

The difficulties that have been recounted briefly in this chapter have nevertheless been overcome time after time in the history of war. Our own campaigns, beginning with Andrew Jackson's superhuman efforts in Florida, and continuing on through the Mexican War, certain campaigns in the Civil War, the Cuban, Philippine, and Porto Rican campaigns, and the recent pacification of Haiti and Nicaragua, have often taken our armed forces into jungles or their equivalent. Foreign armies alike have forced their way at great effort through tropical growths to gain

their ends, notably the British in India and in Africa. The campaign in British East Africa, elsewhere referred to in this text, is perhaps the best modern example of trained native armies operating in jungle country under excellent military leaders.

Of the East African campaign, General Smuts, the British commander, has said: "It is impossible for those unacquainted with German East Africa to realize the physical, transport, and supply difficulties of the advance over this magnificent country . . . with a great rainfall and wide unbridged rivers in the regions of all the mountains, and insufficient surface water on the plains for the needs of an army; with magnificent bush and primeval forest everywhere, pathless, trackless, except for the spoor of the elephant or the narrow footpath of the natives; the malarial mosquito everywhere except on the highest plateaux; . . . the ground almost everywhere a rich black or red cotton soil, which any transport converts into mud in the rain and dust in the drought. In the rainy seasons, which occupy about half the year, much of the country becomes a swamp, and military movements become impracticable. And everywhere the fierce heat of equatorial Africa, accompanied by a wild luxuriance of parasitic life, breeding tropical diseases in the unacclimatized whites. These conditions make life for the white man far from a pleasure trip: if, in addition, he has to make long marches on short rations, the trial becomes very severe; if, above all, huge masses of men and materiel have to be moved over hundreds of miles in a great military expedition against a mobile and alert foe, the strain becomes unendurable." These words were written about East Africa, but they are applicable, and accurately so, to the conditions of any tropical campaign that has ever been conducted.

JUNGLE COMBAT; HISTORICAL EXAMPLE: THE SANTIAGO CAMPAIGN, 1898

The American force which landed at Daiquiri on May 23, 1898 (See Figure 57) had to push through jungle roads and trails to reach its objective—Santiago. The landing continued all night to the accompaniment of men singing in chorus and under the lights of naval searchlights. Fortunately the Spanish forces attempted no resistance or harassment at the beach, although even a small hostile fighting force might have turned the landing into a disaster.

On the next day two columns, one of a single regiment and the other of two, moved forward through the tropical heat. The brigade column advanced along a jungle road and the other column along a nearly parallel trail. After a while these two routes joined and at that point the first resistance was encountered—a stone breastwork on a hill (Las Guasimas) which commanded at several hundred yards the point where the road and trail debouched into a somewhat open ground.

As the heads of the columns came within view of the Spanish defenses the fire of the Spaniards struck them. The commanders of both columns, however, deployed their forces as best they could in the heavy growth and took up the advance toward the breastwork. After some hours of fighting during which the American losses mounted and the Spanish losses were practically nil, the Spanish abandoned their excellent position and hurriedly withdrew.

On the 29th of June the American force again began to advance and reached on 1 July the vicinity of San Juan Hill where there were other Spanish fortifications. Approaching these positions were approximately 11,000 American troops jammed into a single close column hemmed in on both sides by jungle. Cavalry and infantry were mixed together in the densely packed column and

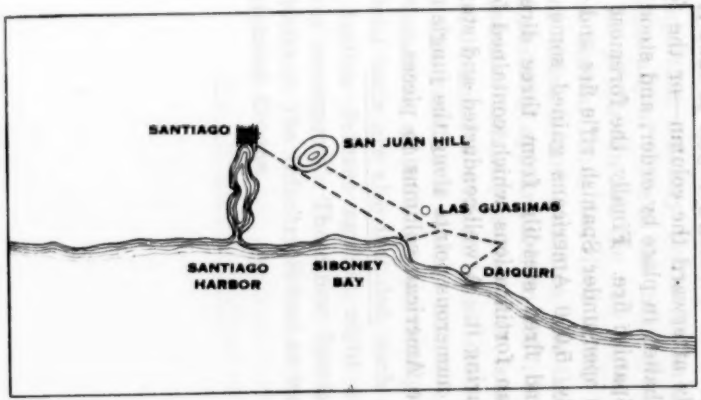

FIGURE 57.—The Santiago Campaign, 1898.

only artillery was lacking in quantity to make it impossible for the force to move at all. Hovering above the column was an engineer officer in an observation balloon, towed by a number of enlisted men.

On seeing the balloon approach, the Spanish commander decided that there must be something under it on the jungle road, and accordingly began to rake it with shrapnel. Shortly afterward the column—or the forward part of it—was halted in place by order, and stood for an hour under the Spanish fire. Finally, the foremost units moved out into the open under Spanish rifle fire and deployed.

Eventually, 5,000 Americans gained some kind of deployment and fired steadily from three directions upon the San Juan fortifications which contained 500 Spanish, finally capturing it. A well-conducted and sturdy defense, however, at numerous points along the jungle trails, would have cut the American columns to pieces.

Brief Reviews of New Infantry Texts

Since the last issue of The Mailing List appeared, a number of important infantry textbooks have come off the press. Especially of value to the infantryman in keeping up with his profession are the new series Army Extension Course Special Texts described briefly below. This series, part of which is now available, and the remainder of which will probably appear early in 1937, is by far the most comprehensive infantry series ever issued. Moreover, they are in general written in an interesting style and are fully illustrated, and contain numerous historical examples. Numerous matters not previously covered in detail in official texts are also included, such as infantry antiaircraft tactics, defense against night attacks, and modern convoy movements. These new Special Texts are used as textbooks at The Infantry School as well as in the Infantry Extension Course.

ARMY EXTENSION COURSES SPECIAL TEXTS

Army Extension Courses Special Text No. 266, Infantry in Offensive Combat, 416 pages, (The Book Shop, The Infantry School; 70 cents).

This text is a comprehensive textbook of infantry offensive combat tactics. It is logically arranged, beginning with the new advance-guard methods carrying through plans, forms, and conduct of attack to reliefs and pursuit. There are also chapters on Tank Employment, Attack in Woods, and Night Attacks. This is the first official text to stress throughout the importance of terrain to the infantry in the attack. It particularly emphasizes also the abandonment of rigid attack formations in favor of flexible small-unit maneuver. The text contains numerous brief historical examples and 120 illustrations. It treats all units from the squad to the brigade.

Army Extension Courses Special Text No. 265, Infantry in Defensive Combat, 309 pages, (The Book Shop, The Infantry School; 50 cents).

This is a companion text to No. 266. It contains a thorough presentation of infantry's part in defensive combat, beginning with defensive plans and organization of the ground and field fortifications, continuing with conduct of the defense, reliefs, security in defensive situations, and defense against night attacks, concluding with retrograde movements—withdrawals, retirements, and delaying action by rear guards. This text, also, contains valuable historical examples and numerous illustrations.

Army Extension Courses Special Text No. 267, Infantry Antiaircraft Defense, 225 pages, (The Book Shop, The Infantry School; 45 cents).

For the first time this text makes available the antiaircraft tactics of infantry. It contains a brief discussion of the historical bases of infantry antiaircraft firing, then presents a full picture of attack aviation methods and the capabilities of infantry weapons in antiaircraft fire. A long chapter is devoted to the tactics of antiaircraft defense, including the air attack by chemicals. There are also numerous small illustrative situations, historical accounts, about 90 illustrations, and an appendix discussing the effect of persistent chemicals sprayed from the air, and giving directions for commanders of units that pass through such an attack.

Army Extension Courses Special Text No. 16, The Tactics and Technique of Associated Arms in the Support of Infantry, 227 pages (The Book Shop, The Infantry School; 45 cents).

Text No. 16 covers tactical employment of Division Artillery, Division Aviation, Division Engineers, Division Cavalry (attached), Chemical Warfare Troops, and Coast Artillery, with especial emphasis on their relationship to Infantry.

Army Extension Courses Special Text No. 270, The Operation of Motor Vehicles. (This text is being printed by the U. S. Government Printing Office and will be available either directly or through The Book Shop, The Infantry School. It will contain roughly 650 pages and will be similar in price to Government publications of similar size).

This new motors text, in addition to being a textbook for use with the Infantry Extension Courses and at The Infantry School, is a treasury of valuable material for the officer who encounters military motor vehicles in quantity for the first time. Throughout, this text has been prepared as an *infantry* text, with the problems of our arm held particularly in mind.

The book contains an extensive chapter on the motor vehicle engine and its various parts. . These are practical rather than theoretical treatments. There is also a long chapter on The Control and Conduct of Group Motor Vehicle Movements Including Convoys. This contains much new and important material for the motorized infantry commander.

There are also comprehensive chapters on motor vehicle maintenance; receiving, storing, and shipping vehicles; vehicle records; troop movements; traffic and other pertinent subjects. This is a modern motorized infantry handbook, and is not presented from the more technical quartermaster motor transport viewpoint.

Army Extension Courses Special Text No. 268, Infantry Signal Communication, 368 pages, (The Book Shop, The Infantry School; 65 cents—cloth bound, 90 cents).

The only complete and up-to-date handbook for the infantry communication officer. This text is the former Infantry School Reference Text No. 10 with minor revisions only.

INFANTRY SCHOOL REFERENCE TEXTS

Theory of Operation of Internal Combustion Engines (Infantry School Reference Text No. 17), 36 pages, (The Book Shop; 15 cents).

Automotive Vehicle Brakes (Infantry School Reference Text No. 18), 95 pages, (The Book Shop; 15 cents).

Automotive Differentials and Rear Axles (Infantry School Reference Text No. 19), 93 pages, (The Book Shop; 15 cents).

These three texts are revisions and amplifications of older textbooks used in the Tank Section of The Infantry School. Like the others of this new series these have been brought up to date in theoretical and practical content. This whole series is invaluable to any officer charged with detailed instruction in the maintenance and operation of automotive vehicles.

Supply of Infantry Units in Campaign (Infantry School Reference Text No. 2-80M), tentative, mimeographed, 49 pages, (The Book Shop; 20 cents).

This is a tentative text covering the methods of supply in the proposed motorized infantry regiment now under study at The Infantry School and elsewhere. Up to the present, it is the only full treatment that has been prepared on this subject.

Machine-gun Battery Drill (*Infantry School Reference Text No. 3-45*), *tentative, mimeographed, 22 pages,* (*The Book Shop; 15 cents*).

This document covers gun drill, tests in gun drill, and battery drill, as recently modified tentatively and as now taught at The Infantry School. The drill described is for use with the new Tripod Mount A-1.

Combat Intelligence For Infantry Units (Infantry School Reference Text No. 1-118M), mimeographed, 23 pages, (The Book Shop; 15 cents).

The latest Infantry School teaching on this subject.

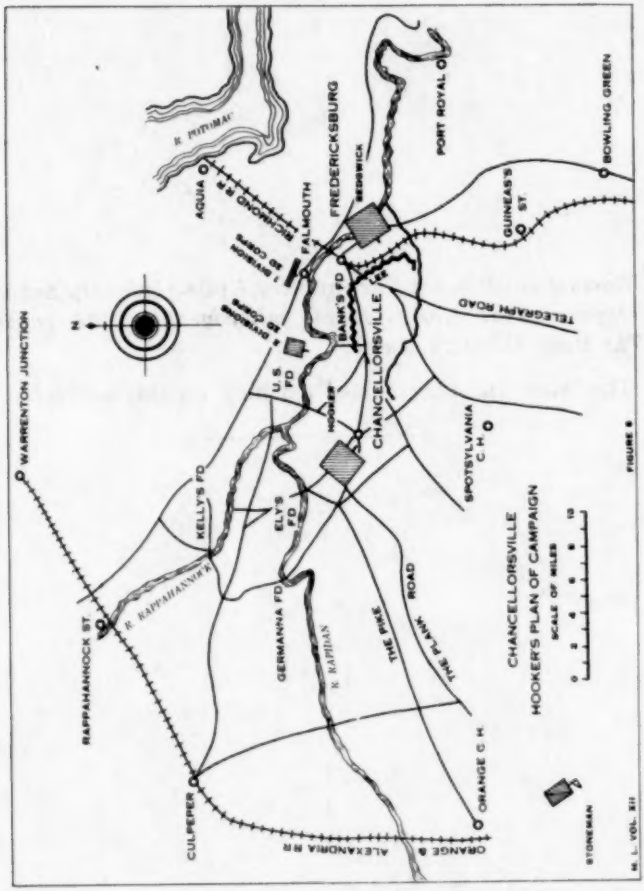
CHANCELLORSVILLE
HOOKER'S PLAN OF CAMPAIGN
SCALE OF MILES
0 2 4 6 8 10
STONEMAN
FIGURE 8
WARRENTON JUNCTION
RAPPAHANNOCK ST
R. RAPPAHANNOCK
KELLY'S FD
CULPEPER
ALEXANDRIA R.R.
ORANGE & H.
ORANGE C. H.
GERMANNA FD
R. RAPIDAN
THE PLANK ROAD
THE PIKE
ELY'S FD
U.S. FD
HOOKER
CHANCELLORSVILLE
BANK'S FD
SPOTSYLVANIA C. H.
TELEGRAPH ROAD
FALMOUTH
FREDERICKSBURG
BERNICK
PORT ROYAL
GUINEA'S ST.
BOWLING GREEN
AQUIA
R. POTOMAC
RICHMOND R.R.
N

FIGURE 8.

DRAMATIS PERSONAE

Von Liman	*Lee*
Hoche	*Hooker*
Von Johan	*Jackson*
Von Leffer	*Longstreet*
Saranoff	*Sedgwick*
Friestadt	*Fredericksburg*
Chernastovna	*Chancellorsville*
Salkirch	*Salem Church*
Haroff	*Hazel Grove*
Feodarvitch	*Fairview*
Sanar River	*Rappahannock River*
Rydal	*Rapidan*
Burgalov	*Burnside*